

# Afrotropical species of the myrmicine ant genera *Cardiocondyla*, *Leptothorax*, *Melissotarsus*, *Messor* and *Cataulacus* (Formicidae)

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## Synopsis

The Afrotropical species of the myrmicine ant genera *Cardiocondyla* Emery, *Leptothorax* Mayr, *Melissotarsus* Emery and *Messor* Forel are revised and keyed, and a revised key to *Cataulacus* F. Smith is presented. At genus-level *Loncyda* Santschi, *Dyclona* Santschi and *Prosopidris* Wheeler are newly synonymized with *Cardiocondyla*; *Nesomyrmex* Wheeler and *Tetramyrma* Forel with *Leptothorax*; and *Veromessor* with *Messor*. The current synonymy of *Aphaenogaster* Mayr, a genus very close to *Messor*, is listed with the inclusion of *Brunella* Forel as a new synonym. At species-level nine *Cardiocondyla* (four new), 11 *Leptothorax* (one new), three *Melissotarsus* and 12 *Messor* (one new) are recognised in the regional fauna. New species-level synonymy includes 10 names in *Cardiocondyla*, three in *Leptothorax*, four in *Melissotarsus* and 14 in *Messor*, most of the last being of former infraspecific names. Five former infraspecific names in *Messor* are given new status here as valid species. In *Cataulacus* six new species are described and four previously synonymized names are reinstated as valid species.

## Introduction

This paper is presented as a further contribution towards a revision of the subfamily Myrmicinae in the Afrotropical region which, for the purpose of this study, excludes the fauna of the Malagasy region. Previously issued parts of this series include studies of the genera *Epitritus* Emery (Bolton, 1972), *Cataulacus* F. Smith (Bolton, 1974), *Decamorium* Forel, *Rhoptromyrma* Mayr and *Triglyphothrix* Forel (Bolton, 1976), *Tetramorium* Mayr (Bolton, 1980), *Meranoplus* F. Smith,

*Dicroaspis* Emery and *Calyptomyrmex* Emery (Bolton, 1981a), *Ankylomyrma* Bolton, *Atopomyrmex* André, *Baracidris* Bolton, *Cyphoidris* Weber, *Ocymyrmex* Emery, *Pristomyrmex* Mayr and *Terataner* Emery (Bolton, 1981b).

With the inclusion of the four genera treated in this paper a total of 20 of the region's 43 presently recognized myrmicine genera have been revised in the present series. The Afrotropical fauna of some myrmicine genera has been studied by Brown who, beside revising *Rhoptromyrmex* (Brown, 1964), has also analysed the genera of the myrmicine tribe Dacetini and revised its main genera on a world-wide basis. In the case of sub-Saharan Africa this included the genera *Serrastruma* Brown (Brown, 1952), *Smithistruma* Brown (Brown, 1953) and *Strumigenys* F. Smith (Brown, 1954).

Prior to these studies very little synthesising work had been carried out on the Afrotropical myrmicines, the only notable contributions being the series of papers produced by Arnold between 1916 and 1926 on the fauna of South Africa, and a catalogue of species by Wheeler (1922) who also included a key to world genera. This key is now very much out of date, is difficult to use and cannot be trusted. Similarly Arnold's (1916) key to the South African myrmicine genera has, through subsequent synonymies and descriptions of new genera, become unusable. More recently Bolton (1973) presented a subfamilial and generic key for the Afrotropical region but again detailed investigation of the individual genera mentioned above has already rendered this partially obsolete. A key to the 19 myrmicine genera in which the antennal club is restricted to two segments has been constructed by Bolton (1981b) and a key to the remaining genera is presently being built up.

The four genera newly revised in this paper, which are discussed in more detail under their individual sections, constitute a relatively minor proportion of the regional fauna in terms of number of species. *Melissotarsus* and *Cardiocondyla* are arbitrarily regarded as small genera, with three and nine species respectively in the region, whilst *Leptothorax* with 11 and *Messor* with 12 species are of moderate size. Apart from *Melissotarsus*, which is restricted to sub-Saharan Africa and Madagascar, most species of the other three genera are primarily distributed elsewhere, the Afrotropical fauna merely representing the few species which have successfully invaded the region from the north.

## Measurements and indices

**Total Length (TL).** The total outstretched length of the individual, from mandibular apex to gastral apex.

**Head Length (HL).** The length of the head proper, excluding the mandibles, measured in a straight line from the anteriormost point of the median clypeal margin to the mid-point of the occipital margin, in full-face view. (In species with strongly concave occipital margin the head length is measured to the mid-point of a line connecting the posterolateral corners.)

**Head Width (HW).** The maximum width of the head in full-face view, measured behind the eyes.

**Cephalic Index (CI).** 
$$\frac{HW \times 100}{HL}$$

**Eye Length (EL).** In *Cataulacus*; the maximum length of the eye in full-face view.

**Ocular Index (OI).** In *Cataulacus*; 
$$\frac{EL \times 100}{HW}$$

**Scape Length (SL).** The maximum straight-line length of the antennal scape excluding the basal constriction or neck. (In *Cataulacus* the SL usually measured in profile view with the scape in its scrobe, as it is usually in this position in mounted specimens.)

**Scape Index (SI).** 
$$\frac{SL \times 100}{HW}$$

**Pronotal Width (PW).** The maximum width of the pronotum in dorsal view.

**Alitrunk Length (AL).** The diagonal length of the alitrunk in profile from the point at which the pronotum meets the cervical shield to the posterior base of the metapleural lobes or teeth. (In *Melissotarsus* measured to posteroventral corner of alitrunk as metapleural lobes absent.)

### Abbreviations of museums

|                  |  |
|------------------|--|
| AMNH, New York   | American Museum of Natural History, New York, U.S.A.   |
| BMNH             | British Museum (Natural History), London, U.K.   |
| IE, Bologna      | Istituto di Entomologia dell'Università, Bologna, Italy.   |
| MCSN, Genoa      | Museo Civico di Storia Naturale 'Giacomo Doria', Genoa, Italy.   |
| MCZ, Cambridge   | Museum of Comparative Zoology, Cambridge, Massachusetts, U.S.A.  |
| MHN, Geneva      | Muséum d'Histoire Naturelle, Geneva, Switzerland.  |
| MNHN, Paris      | Muséum National d'Histoire Naturelle, Paris, France.   |
| MNHU, Berlin     | Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (D.D.R.).                                |
| MRAC, Tervuren   | Musée Royal de l'Afrique Centrale, Tervuren, Belgium.  |
| NM, Basle        | Naturhistorisches Museum, Basle, Switzerland.  |
| NM, Bulawayo     | National Museum, Bulawayo, Zimbabwe. (Hymenoptera from this museum are now deposited in SAM, Cape Town.) |
| NM, Vienna       | Naturhistorisches Museum, Vienna, Austria.   |
| SAM, Cape Town   | South African Museum, Cape Town, South Africa.   |
| USNM, Washington | United States National Museum, Washington, D.C., U.S.A.  |
| ZM, Kiev         | Zoological Museum, Institute of Zoology, Academy of Sciences of Ukrainian S.S.R., Kiev, U.S.S.R.         |

### CARDIOCONDYLA Emery

(Figs 1-7)

*Cardiocondyla* Emery, 1869: 20. Type-species: *Cardiocondyla elegans* Emery, 1869: 21, by monotypy.

*Emeryia* Forel, 1890: cx. Type-species: *Emeryia wroughtonii* Forel, 1890: cxi, by monotypy. [Synonymy by Forel, 1892: 313.]

*Xenometra* Emery, 1917: 96. Type-species: *Xenometra monilicornis* Emery, 1917: 96. (= *Cardiocondyla emeryi* Forel), by monotypy. [Synonymy by Urbani, 1973: 199.]

*Loncyda* Santschi, 1930: 70 [as subgenus of *Cardiocondyla*]. Type-species: *Cardiocondyla (Loncyda) monardi* Santschi, 1930: 70, by monotypy. **Syn. n.**

*Dyclona* Santschi, 1930: 70 [as subgenus of *Cardiocondyla*]. Type-species: *Monomorium cristatum* Santschi, 1912: 163, by original designation. **Syn. n.**

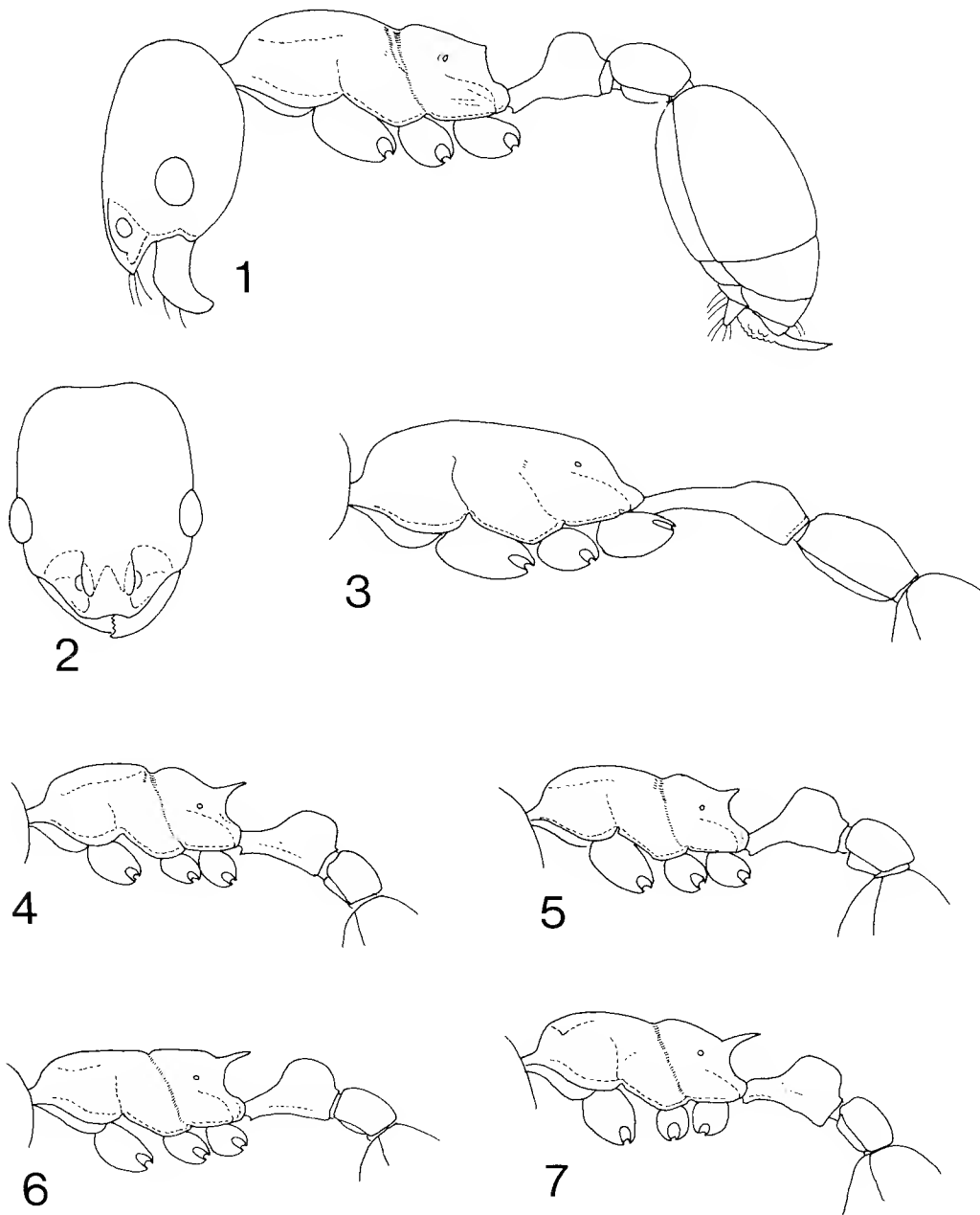
*Prosopidris* Wheeler, 1935: 40 [as subgenus of *Cardiocondyla*]. Type-species: *Cardiocondyla (Prosopidris) sima* Wheeler, 1935: 41, by original designation. **Syn. n.**

*Prosopidris* Wheeler; Reiskind, 1965: 80. [Raised to genus.]

**DIAGNOSIS OF WORKER.** Small to minute monomorphic myrmicine ants. Mandibles with 5 teeth which decrease in size from apical to basal. Palp formula 5, 3 (16 species examined). Clypeus with flattened and prominent projecting lateral portions which are fused to the raised projecting median portion to form a shelf which projects forward over the mandibles (Fig. 2). Sometimes the lateral portions of the clypeus extend further forward than the median so that the anterior margin of the projecting shelf is concave medially. Median portion of clypeus posteriorly broadly inserted between small narrow frontal lobes. Frontal carinae and antennal scrobes absent. Eyes present, generally large and conspicuous, situated in front of the midlength of the sides. Antennae with 11–12 segments, usually with a distinct 3-segmented club but the first club segment may be relatively small. Promesonotal dorsum flattened to evenly convex in profile, the dorsal alitrunk without sutures but the metanotal groove commonly (but by no means universally) impressed. Pronotal corners in dorsal view broadly rounded to bluntly angular and projecting. Propodeal spiracle small, situated approximately at the midlength, often low down on the side but not shifted back towards the margin of the declivity. Propodeum unarmed to strongly bispinose. Metapleural lobes low and rounded. Petiole nodiform with a moderate to long, usually slender, anterior peduncle. Postpetiole dorsoventrally flattened in profile, in dorsal view very broad, much broader than the petiole node. Sting large and strongly developed, knife blade-like and broad in profile, without lamelliform appendages. Dorsal surfaces of body usually hairless.

The genus *Cardiocondyla* contains about 40 species, mostly distributed in the Old World. Discounting tramp species only two have been described from the New World (*ectopia* Snelling and *venustula* Wheeler) but it is quite possible that both represent introductions, although to the present no conspecific forms have been found among Old World material of the genus.

*Cardiocondyla* contains several very successful tramp species which are easily and apparently frequently spread by human commerce. Such tramps include the cosmopolitan *emeryi*, tropicopolitan *wroughtonii* and the Pacific island-hopping *nuda* (Mayr), which sometimes reaches



**Figs 1-7** *Cardiocondyla* workers. 1, profile of *shuckardi*. 2, head of *shuckardi*. 3-7, alitrunk and pedicel segments of (3) *monardi*, (4) *wroughtonii*, (5) *emeryi*, (6) *weserka*, (7) *neferka*.

the Pacific coast of North America. The fauna of the Afrotropical region includes 9 *Cardiocondyla* species. Of these six are found only in this region, two are the common tramps *emeryi* and *wroughtonii*, and one also occurs on Madagascar (*shuckardi*). One of the six endemic species, *zoserka*, described from a series of females, is suspected of being the first inquiline to be found in this genus.

The majority of species of the world are known only from workers; a few queens are known and these are quite normal apart from having the wing venation much reduced. The peculiarity of *Cardiocondyla* lies in the males, which are known to be dimorphic in several species. Ordinary alate males are known for a fair number of species but in some (*emeryi*, *wroughtonii*, *elegans*, *batesii* Forel) dealate, highly ergatoid males are also produced; such peculiar males were responsible for two of the generic names in the synonymy above, *Emeryia* and *Xenometra*. In a further species, *papuana* (Reiskind), the only known male is an ergatoid. The problem is that the extent of ergatoid male production among the species, and the reasons for the production of such males, is unknown. It may well be that all species of *Cardiocondyla* are capable of developing both normal and ergatoid males, given the right conditions, but it may be that some species only have normal alate males, some only have ergatoid males, and some have both. It is certainly an intriguing problem and deserves further investigation.

Recent studies of *Cardiocondyla* include the works of Wilson & Taylor (1967) on the Pacific species, and of Bernard (1956) on the Palaearctic fauna; the species of sub-Saharan Africa have not been dealt with previously.

To the present *Cardiocondyla* has occupied its own tribe, the Cardiocondylini, characterized primarily by its prominent clypeus and broad postpetiole in the worker, and the reduced venation in the female. Other features noted by Emery (1922a) and Wheeler (1922) have been eroded away by subsequent discoveries of species not then known. Nevertheless, the tribal status has remained as such since 1922 although Urbani (1977) has recently pointed out the similarity between *C. monardi* and *Leptothorax*. He interpreted this as convergence but I consider that a real relationship exists between *Leptothorax* and *Cardiocondyla* and that the latter belongs in tribe Leptothoracini. Comparing the two genera there is broad agreement in head shape, dentition, high palp formula, position of eyes, antennal segmentation, size and shape of frontal lobes, broad insertion of the posterior clypeus between the frontal lobes, lack of scrobes and frontal carinae, size and position of propodeal spiracle, and form of the metapleural lobes. The presence of all these characters together in both genera argues strongly that they are genuinely closely related and I propose the dissolution of Cardiocondylini and the incorporation of its sole genus in the Leptothoracini. Within the tribe *Cardiocondyla* is still separated from *Leptothorax* and its close relatives (as discussed under that genus) by the characters devised by Emery and Wheeler, namely the specialized form of the anterior clypeus (although this is hinted at in some *Leptothorax*), the characteristic form of the postpetiole and the reduced wing venation of the females. A further character distinguishing the two is the specialized blade-like sting of *Cardiocondyla*, not seen in *Leptothorax*.

### Synonymic list of Afrotropical *Cardiocondyla* species

#### *emeryi* Forel

*emeryi* var. *rasalamae* Forel **syn. n.**

*emeryi* subsp. *mahdii* Karavaiev **syn. n.**

*monilicornis* Emery

*nuda* subsp. *nereis* Wheeler

*mauritia* Donisthorpe **syn. n.**

#### *monardi* Santschi

*neferka* sp. n.

*nilotica* Weber

*sekhemka* sp. n.

#### *shuckardi* Forel

*globinodis* Stitz **syn. n.**

*badonei* Arnold **syn. n.**

*wassmanni* [sic] Santschi **syn. n.**

*wasmanni* var. *sculptior* Santschi **syn. n.**  
*brevispinosa* Weber **syn. n.**  
*fusca* Weber **syn. n.**  
*weserka* **sp. n.**  
*wroughtonii* (Forel)  
*wroughtonii* var. *hawaiensis* Forel  
*emeryi* subsp. *chlorotica* Menozzi **syn. n.**  
*zoserka* **sp. n.**

### Key to species (workers)

Note. *C. zoserka*, described from suspected inquiline females, is omitted from the key.

- 1 With alitrunk in profile the dorsum without trace of a metanotal groove or impression (Fig. 3).  
 Propodeum unarmed. Postpetiole in dorsal view distinctly longer than broad. (Angola)  
*monardi* (p. 314)
- With alitrunk in profile the dorsum with a distinct metanotal groove or impression (Figs 1, 4–7).  
 Propodeum sharply angulate to bispinose. Postpetiole in dorsal view as broad as to markedly  
 broader than long . . . . . 2
- 2 With the head in full-face view the scapes, when laid back, distinctly exceeding the occipital  
 corners. (Sudan) . . . . . *nilotica* (p. 315)
- With the head in full-face view the scapes when laid back, either failing to reach or just reaching  
 the occipital corners, never exceeding them . . . . . 3
- 3 Dorsal surfaces of head and alitrunk smooth and glossy, unsculptured everywhere except for  
 widely separated minute punctulae on the head. Head relatively broad and scapes short, CI 86,  
 SI 74. (Ghana) . . . . . *sekhemka* (p. 315)
- Dorsal surfaces of head, alitrunk or both finely and densely sculptured, the sculpture usually  
 conspicuous. Scapes longer, SI > 80. Head with CI usually < 80, rarely otherwise . . . . . 4
- 4 Propodeum in absolute profile bluntly angulate to bidenticulate (Fig. 1), never with a pair of  
 strong teeth or spines which are longer than their basal width in profile and which are as long  
 as half the distance separating their bases in dorsal view. Scapes relatively long, SI in range  
 93–100. (Widespread in sub-Saharan Africa; Madagascar) . . . . . *shuckardi* (p. 316)
- Propodeum in absolute profile strongly bidentate to bispinose (Figs 4–7), the teeth or spines  
 longer than their basal width in profile and at least as long as half the distance separating their  
 bases in dorsal view. Scapes relatively short, SI in range 81–94. . . . . 5
- 5 With alitrunk in profile the propodeal dorsum approximately flat behind the metanotal groove  
 and more or less level with the promesonotal dorsum, the propodeal dorsum not showing a  
 long gradual slope down to the spines (Fig. 6). (Cameroun) . . . . . *weserka* (p. 317)
- With alitrunk in profile the propodeal dorsum convex behind the metanotal groove and then  
 showing a long gradual slope down to the spines (Figs 4, 5, 7) . . . . . 6
- 6 With alitrunk in profile the mesonotal dorsum abruptly changing slope posteriorly and  
 descending steeply to the metanotal groove (Fig. 4). Petiole node in dorsal view subglobular,  
 usually slightly broader than long. Head relatively broad, CI in range 79–86. (Pantropical  
 tramp species) . . . . . *wroughtonii* (p. 317)
- With alitrunk in profile the mesonotal dorsum curving evenly into the metanotal groove, without  
 an abrupt change of slope posteriorly (Figs 5, 7). Petiole node in dorsal view not subglobular,  
 usually quite distinctly longer than broad. CI in range 72–79 . . . . . 7
- 7 Pronotal corners bluntly but conspicuously angular in dorsal view. Propodeal spines relatively  
 long and slender (Fig. 7). (Ghana, Cameroun). . . . . *neferka* (p. 314)
- Pronotal corners rounded in dorsal view. Propodeal spines relatively short and stout (Fig. 5).  
 (Cosmopolitan tramp species, very common) . . . . . *emeryi* (p. 312)

### *Cardiocondyla emeryi* Forel

(Fig. 5)

*Cardiocondyla emeryi* Forel, 1881: 5. Syntype workers, VIRGIN Is.: St Thomas I. 1878 (MHN, Geneva)  
 [examined].

*Cardiocondyla emeryi* var. *rasalamae* Forel, 1891: 161. Syntype workers, MADAGASCAR: Imerina (P.  
 Camboué) (MHN, Geneva) [examined]. **Syn. n.**

- Cardiocondyla emeryi* subsp. *muhdii* Karavaiev, 1911: 8. Syntype workers, SUDAN: Khartoum, Sirdargarten, no. 1900 (*V. Karavaiev*) (ZM, Kiev) [examined]. **Syn. n.**
- Xenometra monilicornis* Emery, 1917: 96. Holotype ergatoid male [not female], VIRGIN Is.: St Thomas I. (MCSN, Genoa). [Synonymy by Urbani, 1973: 200.]
- Cardiocondyla nuda* subsp. *nereis* Wheeler, 1927: 140. Syntype workers, females, NORFOLK I.: 1915 (*A. M. Lea*) (MCZ, Cambridge). [Synonymy by Wilson & Taylor, 1967: 53.]
- Cardiocondyla mauritia* Donisthorpe, 1946: 776. Holotype and paratype workers, MAURITIUS: 1941–45, no. 102 (*R. Mamet*) (BMNH) [examined]. **Syn. n.**

WORKER. TL 1.7–2.1, HL 0.45–0.52, HW 0.34–0.38, CI 72–78, SL 0.30–0.36, SI 86–94, PW 0.22–0.28, AL 0.48–0.58 (40 measured).

Antennal scapes of moderate length (SI, above), when laid back on the head usually failing to reach the occipital corners but in a few samples just reaching them; never distinctly exceeding the occipital corners. Maximum diameter of eye 0.10–0.12, about 0.28–0.32 × HW and with 8–10 ommatidia in the longest row. Head always conspicuously longer than broad in full-face view, CI > 80 in all samples examined. With the alitrunk in dorsal view the pronotal corners narrowly but evenly rounded, not produced into angular shoulders. In profile the alitrunk with the promesonotal dorsum forming an even shallow convexity from front to back, the slope of the dorsum not changing radically just in front of the metanotal groove. Metanotal groove sharply and conspicuously impressed, the propodeal dorsum convex behind the groove, then entering a long slope down to the propodeal spines. In profile the propodeal spines short and stoutly constructed but longer than their basal width. In dorsal view each spine longer than half the distance separating their bases. Petiole and postpetiole shaped as in Fig. 5, the petiole node showing some variation in shape but in dorsal view always at least as long as broad and usually distinctly longer than broad. Peduncle of petiole moderately long, the sternite of the postpetiole showing a blunt anteroventral prominence or bulge. Postpetiole in dorsal view much broader than long, with a shallowly concave anterior margin and evenly convex sides. Dorsal surfaces of head and alitrunk usually with scattered fine punctures, the surface between them finely and densely shagreened or granular. In some specimens the punctures are very small or widely scattered and inconspicuous, in which case the entire surface appears shagreened to granular. Occasionally the granular ground-sculpture is reduced leaving the fine punctures on a more or less smooth surface. Sculpture on the dorsal head is frequently stronger and better defined than on the dorsal alitrunk. Hairs absent except on mouthparts and around gastral apex but a fine appressed pubescence is present all over the body, being more conspicuous on the darkly coloured gaster than elsewhere. Head and alitrunk yellow to light brown, sometimes orange-brown; gaster much darker, blackish brown to black and contrasting strongly with the head and alitrunk.

A well known highly successful tramp-species, *emeryi* has been spread widely over the earth's surface, mainly by human commerce. In the tropics and subtropics it survives outside, but in the temperate zones it is more or less restricted to constantly heated buildings and greenhouses. The presence of two very closely related species in West Africa, *neferka* and *weserka*, implies that the Afrotropical region is most probably the place of origin of *emeryi*.

Like a few other species *emeryi* is known to have dimorphic males (see discussion, p. 311). The species usually produces normal winged males but sometimes also develops highly ergatoid males which may be found wandering alone, far from any nest.

#### MATERIAL EXAMINED

Afrotropical region. **Ghana:** Polcoase (*W. Bellfield*); Kibi (*D. Leston*). **Nigeria:** Gambari (*B. Bolton*); Bussa (*J. T. Medler*). **Cameroun:** Nkoemvon (*D. Jackson*). **Angola:** Luanda (*G. R. Gradwell & D. Snow*). **Sudan:** Khartoum (*V. Karavaiev*). **Uganda:** Ruwenzori, Semliki Forest (*D. S. Fletcher*). **Kenya:** Embu, Ishiara (*V. Mahnert & J.-L. Perret*). **Tanzania:** Lindi (*D. V. Fitzgerald*); Manyara Nat. Park (*M. E. Irwin & E. S. Ross*); Zanzibar (*L. F. Brown*). **Zimbabwe:** Bembesi (*G. Arnold*). **Botswana:** Shorobe (*A. Russell-Smith*). **South Africa:** Durban (*C. B. Cooper*); Nelspruit (*M. Samways*).

Other regions. **Madagascar:** Joffreville (*J. M. Betsch*); Imerina (*P. Camboué*). **Seychelles:** Little Sister I. (*U. Müller*). **Aldabra:** South I. (*B. Cogan & A. M. Hutson*). **Chagos Archipelago:** Diego Garcia (*A. M. Hutson*). **Ascension I.** (*E. A. G. Duffey*). **Egypt:** Gizeh (*F. Morey*); Siwa (*J. Omer-Cooper*); Zegawa (*J. Omer-Cooper*). **Madeira:** Funchal (*N. L. H. Krauss*). **Cape Verde Is.:** Fogo (*Lindberg*); Fogo (*Groh*); S. Vincente (*Lindberg*); S. Tiago (*Lindberg*); Nicolau (*Lindberg*); St Helena (*Wollaston*). **Virgin Is.:** St Vincent I. (*H. H. Smith*); St Thomas I. **West Indies:** Anguilla (*A. G. Parker*). **Puerto Rico:** Mayaguez (*M. R. Smith*). **Norfolk I.** (*A. M. Lea*). **Mauritius** (*R. Mamet*).

For Pacific distribution see Wilson & Taylor (1967); for Neotropical distribution see Kempf (1972).

*Cardiocondyla monardi* Santschi

(Fig. 3)

*Cardiocondyla (Loncyda) monardi* Santschi, 1930: 70, fig. 5. Syntype workers, ANGOLA: Rio Mbalé, ix.1928–i.1929 (*A. Monard*) (NM, Basle) [examined].

WORKER. TL 2.7, HL 0.58, HW 0.46, CI 79, SL 0.49, SI 107, PW 0.33, AL 0.68.

Antennal scapes relatively long, SI > 100; when laid back on the head exceeding the occipital corners. Maximum diameter of eye 0.14, about  $0.30 \times$  HW and with approximately 14 ommatidia in the longest row. Pronotal corners in dorsal view broadly and evenly rounded. Alitrunk in profile with the dorsum forming a single uninterrupted surface, without trace of a metanotal groove or impression. Propodeum unarmed, the dorsum rounding broadly, smoothly and evenly into the declivity. Petiole in profile with a very long anterior peduncle and a long low feebly convex node. Petiole node in dorsal view subglobular, only very slightly longer than broad. Postpetiole in dorsal view somewhat longer than broad, narrow (c. 0.13) at its junction with the petiole, then rapidly broadening posteriorly to a maximum width of c. 0.26 at about its midlength, and behind this narrowing again to a posteriormost width of c. 0.20. Dorsal length of postpetiole about 0.30, of petiole peduncle plus node about 0.40. All dorsal surfaces of head, alitrunk, petiole, postpetiole and first gastral tergite reticulate-punctate. Whole of body dorsally with glinting silvery pubescence which is mostly set within the punctures. Colour yellow with glinting silvery highlights due to the pubescence.

This very distinctive species should not be confused with any other African form. It is quickly separated from all its congeners in the Afrotropical region by its long scapes, lack of a metanotal groove or impression, absolutely unarmed propodeum, elongate pedicel segments and glinting silvery pubescence on a yellow background.

## MATERIAL EXAMINED

Angola: Rio Mbalé (*A. Monard*).

*Cardiocondyla neferka* sp. n.

(Fig. 7)

HOLOTYPE WORKER. TL 1.8, HL 0.48, HW 0.36, CI 75, SL 0.32, SI 89, PW 0.26, AL 0.49.

Antennal scapes of moderate length (SI 87–91 in type-series), when laid back on the head not reaching the occipital corners in full-face view. Maximum diameter of eye 0.11, about  $0.31 \times$  HW and with 9–10 ommatidia in the longest row. Head conspicuously longer than broad, CI < 80. Pronotum in dorsal view with narrowly rounded, somewhat prominent corners, giving the ant a conspicuously square-shouldered appearance. With the alitrunk in profile the promesonotum forming an even shallow convexity from front to back which grades into the metanotal groove without passing through an abrupt change of slope. Metanotal groove shallowly impressed, the propodeal dorsum shallowly convex behind the groove, then sloping downwards posteriorly towards the spines. Propodeal spines elongate and narrow, in profile much longer than their basal width; in dorsal view the spines slightly incurved and each as long as the distance separating their bases. Shape of pedicel segments as in Fig. 7. In dorsal view the petiole node longer than broad, the postpetiole distinctly broader than long and broadest at its midlength. Dorsum of head shagreened-granular, the sculpture very fine and dense, blanketing the surface. Promesonotal dorsum very finely and densely superficially shagreened and mat, but the propodeal dorsum with only vestigial sculpture and glossy, much less densely sculptured than the promesonotum. Dorsal surfaces of petiole, postpetiole and gaster unsculptured except for a faint and patchy superficial patterning. Hairs absent except on mouthparts but a fine appressed pubescence is present which is most apparent on the gaster. Colour uniform light brownish yellow, the dorsum of the head slightly darker than the sides; sides of the first gastral tergite a rich darker brown.

PARATYPE WORKERS. TL 1.80–1.81, HL 0.46–0.48, HW 0.35–0.37, CI 76–79, SL 0.32–0.33, SI 87–91, PW 0.24–0.27, AL 0.48–0.51 (3 measured).

Maximum diameter of eye 0.10–0.11, about  $0.27\text{--}0.31 \times$  HW and with 9–10 ommatidia in the longest row. As holotype but in a couple the darker colour of the sides of the first gastral tergite extends onto the dorsum.

Holotype worker, Ghana: Mampong, 10.ii.1970 (*P. Room*) (BMNH).

Paratypes. 3 workers with same data as holotype (BMNH; NM, Basle; MCZ, Cambridge).

Non-paratypic material examined. Cameroun: Nkoemvon (*D. Jackson*).



The Cameroun material differs from the type-series only in colour as here the dorsum of the head is conspicuously much darker than the sides and the gaster is uniformly dark brown. This is merely an intensification of the condition seen in the type-series and has no significance at species-level.

*C. neferka* is closest related to *emeryi* but is quickly separable by its elongate narrow propodeal spines and conspicuously square-shouldered appearance when the pronotum is seen in dorsal view.

### *Cardiocondyla nilotica* Weber

*Cardiocondyla nilotica* Weber, 1952: 8, fig. 13. Holotype worker, SUDAN: White Nile R., Ed Dueim, lat. 14° 00' N., 2.vii.1939, no. 1234 (*N. A. Weber*) (not in AMNH, New York; presumed lost).

The only known representative of this species cannot be found in AMNH, New York and must be presumed lost. However, Weber's original description contains enough information to give a reasonable picture of this species, and it appears distinct from all other species of the Afrotropical region. The following diagnostic characters are taken from Weber's description.

WORKER. TL 2.5. Antennal scapes when laid back distinctly exceeding the occipital corners. Metanotal groove broad and rounded-concave. Propodeum armed with a pair of short triangular tubercles. Peduncle of petiole slender. Petiole node in dorsal view broader than long, the postpetiole slightly broader than long (taken from Weber's fig. 13, where the postpetiole appears subglobular in dorsal view). Densely and finely punctate on head and alitrunk, gaster smooth and shining. Colour bright ferruginous, the head with a dark area dorsally; appendages pale and gaster dark brown.

The overall picture which emerges is of a relatively large species closely related to *shuckardi* but with decidedly longer scapes, narrower postpetiole and lighter colour, although a few pale coloured individuals of *shuckardi* are known.

### *Cardiocondyla sekhemka* sp. n.

HOLOTYPE WORKER. TL 1.8, HL 0.44, HW 0.38, CI 86, SL 0.28, SI 74, PW 0.12, AL 0.32.

Head relatively short and broad, scapes relatively short (CI and SI, above). When laid back on the head the scapes failing to reach the occipital corners in full-face view. Projecting median portion of clypeus and flattened prominent lateral parts of clypeus closely fused and forming a more or less evenly semicircular projecting lobe which hides most of the mandibles in full-face view (only the two apicalmost teeth of the right mandible can be seen in the holotype). Eyes relatively large, maximum diameter 0.12, about  $0.32 \times$  HW and with 10–11 ommatidia in the longest row. Shape of eye irregular in profile, narrowed and drawn out anteroventrally, rounding the lower curve of the sides and onto the margins of the ventral surface of the head. Pronotal corners rounded in dorsal view. With alitrunk in profile the promesonotum evenly convex from front to back, sloping posteriorly to the feebly impressed metanotal groove. Propodeal dorsum more shallowly convex than promesonotum and on a much lower level so that there is a distinct step-down from the promesonotum to the propodeum. Posteriorly the propodeal dorsum sloping down to a pair of broad blunt and very low tubercles which are much shorter than the metapleural lobes and which are shorter than their basal widths. In dorsal view the tubercles distinctly shorter than half the distance separating their bases. Petiole in profile with a short peduncle and rounded node. In dorsal view the petiole node subglobular, slightly broader than long. Postpetiole in dorsal view much broader than long, with a shallowly concave anterior margin and evenly convex sides. Dorsum of head sculptured with widely scattered superficial minute punctulae, the surface between the punctulae smooth and shining. Remainder of body unsculptured, smooth and shining. Hairs absent except on mouthparts and gastral apex. Colour uniform glossy blackish brown, the legs and antennae lighter.

Holotype worker, **Ghana**: Tumu, 24.xii.1969 (*P. Room*) (BMNH).

This small, virtually unsculptured darkly coloured species is easily recognised by its relatively short scapes, broad head, characteristically shaped eyes, lack of developed propodeal spines and feebly impressed metanotal groove followed by a depressed propodeum. In the Afrotropical region only *wroughtonii* approaches the CI value of *sekhemka*, but in that species the propodeal spines are long and strongly developed. Only *shuckardi* has the propodeal armament as feebly developed as in *sekhemka* but here the head and body are usually strongly sculptured, the eye is not drawn out anteroventrally, and the dimensions are very different.

*Cardiocondyla shuckardi* Forel

(Figs 1, 2)

- Cardiocondyla shuckardi* Forel, 1891: 161. Syntype workers, MADAGASCAR: Imerina, Antananarivo (Camboué) (MHN, Geneva) [examined].
- Cardiocondyla globinodis* Stitz, 1923: 154. Syntype workers, SOUTH WEST AFRICA: Omaruru, 22.vi.1911 (W. Michaelsen) (MNHU, Berlin) [examined]. **Syn. n.**
- Cardiocondyla badonei* Arnold, 1926: 225, fig. 64. Syntype workers, MOZAMBIQUE: Amatongas Forest, ii.1917 (G. Arnold) (BMNH; MCZ, Cambridge) [examined]. **Syn. n.**
- Cardiocondyla wasmanni* [sic] Santschi, 1926: 241. Holotype worker, CAMEROUN: Gr. Batanga (R. P. E. Wasmann) (NM, Basle) [examined]. **Syn. n.**
- Cardiocondyla wasmanni* var. *sculptior* Santschi, 1926: 241. Holotype worker, GABON: Samkita (F. Faure) (NM, Basle) [missing from mount]. **Syn. n.**
- Cardiocondyla brevispinosa* Weber, 1952: 6. Holotype worker, ZAIRE: Beni, lat. 0° 24' N., long. 29° 24' E., 24.ii.1948, no. 2116 (N. A. Weber) (not in AMNH, New York; presumed lost). [Junior secondary homonym of *Pheidole brevispinosa* Donisthorpe 1947: 593 (= *Cardiocondyla paradoxa* Emery); synonymy by M. R. Smith, 1955: 305.] **Syn. n.**
- Cardiocondyla fusca* Weber, 1952: 7. Holotype worker, UGANDA: Jinja, 15.viii.1939, no. 1495 (N. A. Weber) (not in AMNH, New York; presumed lost). **Syn. n.**

WORKER. TL 2.0–2.6, HL 0.50–0.60, HW 0.38–0.46, CI 75–79, SL 0.36–0.45, SI 93–100, PW 0.27–0.35, AL 0.54–0.69 (35 measured).

Antennal scapes when laid back on the head in full-face view either just failing to reach or just reaching the occipital corners, never distinctly surpassing them; the scapes moderately long, SI > 90. Maximum diameter of eye 0.11–0.14, about 0.26–0.30 × HW and with 9–12 ommatidia in the longest row. Head always obviously longer than broad, CI < 80 in material examined. Pronotal corners in dorsal view broadly and evenly rounded. With the alitrunk in profile the promesonotal dorsum forming an even shallow convexity from front to back, sloping evenly into the metanotal groove. Metanotal groove impressed but the depth of the impression varying between samples. To some extent the apparent variation in depth is caused by the convexity of the propodeum behind the groove as in some cases it rises more steeply and is more convex than in others. Propodeal dorsum behind the convex portion sloping downwards posteriorly to the junction with the declivity. Propodeal armament very reduced, at best represented only by a pair of minute triangular denticles which may be acute or blunted, or by a pair of tubercles, or merely bluntly angular; never with developed teeth or spines (Fig. 1). In dorsal view the propodeal armament scarcely visible, the length of each component constituting only a fraction of the distance separating their bases. Petiole node in dorsal view subglobular, usually broader than long but in some only about as broad as long. Postpetiole distinctly broader than long. In profile the petiole and postpetiole as in Fig. 1, the petiolar dorsum convex and somewhat variable in length. Sculpture of dorsal head and alitrunk usually of fine, very dense blanketing shagreening or granulation, but this may be reduced on the alitrunk or even on the head, though less frequently on the latter than on the former. In extreme cases the dorsal alitrunk may be almost smooth. Hairs absent except on mouthparts and gastral apex. Colour varying from medium brown to blackish brown, sometimes black.

The commonest and most widespread endemic species in the Afrotropical region, *shuckardi* is recognised by its dimensions and extremely reduced propodeal armament. Other species in the region with reduced propodeal armament include *monardi*, *sekhemka* and *nilotica*. In the first of these the metanotal groove is absent and the pedicel segments are very elongate (Figs 1, 3). *C. sekhemka* is a much smaller species with shorter scapes and a broader head, and *nilotica* has longer scapes than *shuckardi* and a narrower postpetiole.

## MATERIAL EXAMINED

**Ghana:** Kibi (D. Leston); Mampong (P. Room); Mole G. R. (J. C. Greig). **Nigeria:** Ibadan (K. Whitney); Ibadan (B. Critchley). **Cameroun:** Nkoemvon (D. Jackson); Batanga (Wasmann). **Zimbabwe:** Umtali (G. Arnold). **Botswana:** Shorobe (A. Russell-Smith). **South West Africa:** Okahanja (P. Hammond); Omaruru (W. Michaelsen). **South Africa:** Transvaal, Plaston (M. Samways); Nelspruit (M. Samways); Natal, Ubombo (W. L. & D. E. Brown); Illovo (P. Atkinson). **Mozambique:** Amatongas Forest (G. Arnold). **Madagascar:** Mont d'Ambre (J. M. Betsch); Antananarivo (Camboué).

*Cardiocondyla weserka* sp. n.

(Fig. 6)

HOLOTYPE WORKER. TL 1.9, HL 0.46, HW 0.35, CI 76, SL 0.32, SI 91, PW 0.25, AL 0.48.

Antennal scapes moderately long but when laid back on the head failing to reach the occipital corners in full-face view. Maximum diameter of eye 0.12, about  $0.34 \times HW$  and with 9–10 ommatidia in the longest row. Pronotum in dorsal view with the corners narrowly rounded but not prominent. With the alitrunk in profile the promesonotum with its dorsum almost flat, rounding broadly into its anterior declivity but running into the metanotal groove almost in a straight line, with only the feeblest of curves. Metanotal groove narrowly but quite distinctly impressed. Behind the metanotal groove the propodeal dorsum more or less flat and on a slightly higher level than the posterior part of the promesonotum; the propodeal convexity behind the metanotal groove followed by a long slope down to the spines, which is characteristic of most species of the region, is absent here. Propodeal spines elongate and narrow, much longer than their basal width in profile; in dorsal view the spines somewhat incurved, each spine easily as long as the distance separating their bases. Shape of pedicel segments in profile as in Fig. 6. In dorsal view the petiole node conspicuously longer than broad, its dorsal surface narrow. Postpetiole much broader than long, its anterior face slightly concave, its sides convex. Dorsum of head blanketed by a fine dense granular sculpture or shagreening. Dorsal promesonotum more lightly shagreened than head, the sculpture here being extremely fine and very dense indeed. Propodeal dorsum with same sculpture as promesonotum but somewhat weaker and appearing shiny in places. Petiole and postpetiole very finely and superficially shagreened. Hairs absent except on mouthparts but a fine appressed pubescence is present, most easily visible on the first gastral tergite. Alitrunk medium brown, the appendages slightly lighter. Head dorsally and gaster blackish brown to black. Pedicel segments intermediate in shade between alitrunk and gaster.

Holotype worker, **Cameroun**: Nkoemvon, 1980, no. M35 (*D. Jackson*) (BMNH).

Among the species of the region in which the metanotal groove is impressed, *weserka* is immediately distinguished by the shape of the propodeal dorsum. In general the propodeal dorsum is convex behind the groove and then enters a long slope down to the tubercles, spines or teeth (Figs 1, 4, 5, 7), but in *weserka* the dorsum is almost flat and does not conform to this usual shape (Fig. 6).

*Cardiocondyla wroughtonii* (Forel)

(Fig. 4)

*Emeryia wroughtonii* Forel, 1890: cxi. Holotype male [ergatoid, not worker], INDIA: Poona (*Wroughton*) (MHN, Geneva) [examined].

*Cardiocondyla wroughtonii* (Forel) Forel, 1892: 313.

*Cardiocondyla wroughtonii* var. *hawaiiensis* Forel, 1899: 119. Syntype workers, HAWAII: Molokai (MHN, Geneva). [Synonymy by Wilson & Taylor, 1967: 56.]

*Cardiocondyla emeryi* subsp. *chlorotica* Menozzi, 1930: 84. Syntype workers, female, SOMALI REPUBLIC: Duca Abruzzi, x.1926 (*G. Paoli & A. Chiaromonte*) (IE, Bologna) [examined]. **Syn. n.**

WORKER. TL 1.6–1.9, HL 0.42–0.50, HW 0.34–0.40, CI 79–86, SL 0.30–0.36, SI 81–89, PW 0.24–0.28, AL 0.46–0.55 (25 measured).

Small species with relatively broad head and short scapes, CI and SI above. When laid back on the head the scapes failing to reach the occipital corners in full-face view. Maximum diameter of eye 0.09–0.11, about  $0.26–0.30 \times HW$  and with 9–11 ommatidia in the longest row. Pronotal corners rounded in dorsal view. With the alitrunk in profile the promesonotum forming a shallow convexity from front to back but the slope changing sharply posteriorly and becoming quite steep where it slopes down to the strongly impressed metanotal groove; this change in slope very conspicuous in absolute profile. Propodeal dorsum behind the metanotal groove convex in profile, then entering a long downward slope to the propodeal spines. Propodeal spines enlongate and narrow in profile, longer than their basal width; in dorsal view each spine as long as the distance separating their bases. Petiole node in dorsal view subglobular, as broad as or slightly broader than long. Postpetiole distinctly broader than long. Dorsal surfaces of head and alitrunk blanketed by fine shagreening or punctulate shagreening. Petiole and postpetiole finely superficially shagreened. Hairs absent except on mouthparts and gastral apex but a sparse appressed pubescence is present, easiest seen on the first gastral tergite. Head, alitrunk and appendages yellow to yellowish brown, colour of gaster variable. Frequently the gaster is the same colour as the head and alitrunk but in some the sides of the tergite are

darker than the dorsum. In others the darker colour has also extended across the posterior portion of the first tergite and in some the gaster is uniformly dark.

A tramp species probably originating in South East Asia, *wroughtonii* is now widespread in the tropics and subtropics. Amongst the Afrotropical region species *wroughtonii* is recognizable by its small size, relatively short scapes and broad head, subglobular petiole node in dorsal view, and the characteristic shape of the promesonotum in profile. In terms of CI it is approached only by *sekhemka*, but this species is uniformly dark in colour, has much shorter scapes (SI 74), and has a differently shaped alitrunk.

#### MATERIAL EXAMINED

Afrotropical Region. **Somali Republic:** Duca Abruzzi (Paoli & Chiaromonte). **Tanzania:** Dar es Salaam (A. J. Halstead); Zanzibar (M. J. Way).

Other regions. **West Malaysia:** Alor Star (G. H. Lowe); Gombak (B. Bolton). **Australia:** Qld, Mackay (R. E. Turner). **Japan:** Chichi-jima, Ogasahara (M. Tanaka). **Hawaii:** Molokai (R. C. L. Perkins). **Sri Lanka:** Peradeniya (A. Rutherford); Nawalapitiya. **India:** Poona (Wroughton); Pusa (S. D. Agarwala). **Thailand.** **U.S.A.:** Fla, Dade Co., Tamiami Trail (W. F. Buren).

#### *Cardiocondyla zoserka* sp. n.

HOLOTYPE FEMALE. TL 3.3, HL 0.68, HW 0.55, CI 81, SL 0.46, SI 84, PW 0.47, AL 1.04.

With the head in full-face view the outer margins of the mandibles conspicuously sinuate, passing through a right-angle apically and forming a flat transverse anterior margin along to the apical tooth. Masticatory margin of mandible with the usual five teeth but the apical tooth considerably enlarged, the three basalmost teeth very small. Form of clypeus more *Leptothorax*-like than is usual in the genus, with a broadly and evenly convex anterior lobe which projects over the base of the mandibles and with an impressed area between the frontal lobes behind the posterior margin of the clypeus. Funicular segments of antennae with bizarre modification and highly characteristic. In dorsal view funicular segment 1 slightly longer than broad, 2 slightly broader than long, but thereafter segments 3–10 short and very broad, becoming even broader apically and with segments 8–10 extremely broad. The apical funicular segment swollen-conical in dorsal view. In ventral view the funiculus even more bizarre. Segments 1–5 appearing the same as in dorsal view, segments 6–7 flattened dorsoventrally, segment 8 slightly transversely concave, the very broad segment 9 strongly transversely concave and segment 10 so concave that the strongly arched ventral surface appears almost to touch the dorsal at the point of maximum concavity. Apical segment invaginated and forming a cup-shaped hollow which extends deep into the segment. Ocelli distinct. Maximum diameter of eye 0.24, about  $0.44 \times \text{HW}$ . With alitrunk in dorsal view the mesoscutum slightly broader than long, the rounded pronotal corners visible anteriorly. In profile the propodeal dorsum sloping down posteriorly to a pair of small acute denticles. Petiole and postpetiole nodes both distinctly broader than long in dorsal view. Dorsal surfaces of head, mesoscutum and scutellum granular to shagreened, with scattered punctures, the mesoscutum also with very faint striate vestiges longitudinally. Dorsal propodeum with ground-sculpture vestigial to absent, with a few feeble transverse rugulae. Petiole, postpetiole and gaster with scattered minute punctulae dorsally. Hairs absent except on mouthparts but the body with a fairly dense and quite conspicuous appressed pubescence which is most easily visible on the first gastral tergite. Colour dark brown to blackish brown, the appendages lighter.

PARATYPE FEMALES. TL 2.9–3.3, HL 0.62–0.67, HW 0.51–0.55, CI 82–84, SL 0.42–0.46, SI 82–85, PW 0.42–0.46, AL 0.90–1.00 (4 measured).

As holotype but may be slightly lighter in colour. Sculpture reduced in some, the propodeal dorsum almost smooth and the dorsal alitrunk less intensely sculptured. Maximum diameter of eye 0.21–0.24, about  $0.41\text{--}0.44 \times \text{HW}$ .

Holotype female, **Nigeria:** nr Abuja, Gurara Falls, 20.iii.1972 (E. Classey) (BMNH).

Paratypes. 4 females with same data as holotype (BMNH; NM, Basle; MCZ, Cambridge).

Although it is not usual practice to describe ant species from isolated females I make an exception in this case for two reasons. Firstly, the modification of the mandibles, clypeal structure and antennal funiculi lead me to suspect that this species is an inquiline. Secondly, the bizarre modification of the funiculi renders the species immediately recognizable. To the best of my knowledge no other ant has funiculi even remotely resembling this one, and certainly they cannot be confused with any other member of *Cardiocondyla*. Assuming that I am correct in my

supposition that *zoserka* is an inquiline species (which makes it the first one known in the genus), it is interesting to speculate what its host might be. Apart from the modifications of the head and its appendages the overall appearance of *zoserka* is very like that of *shuckardi* females. The two are definitely closely related and it may be that *shuckardi* represents the host of *zoserka*.

### LEPTOTHORAX Mayr

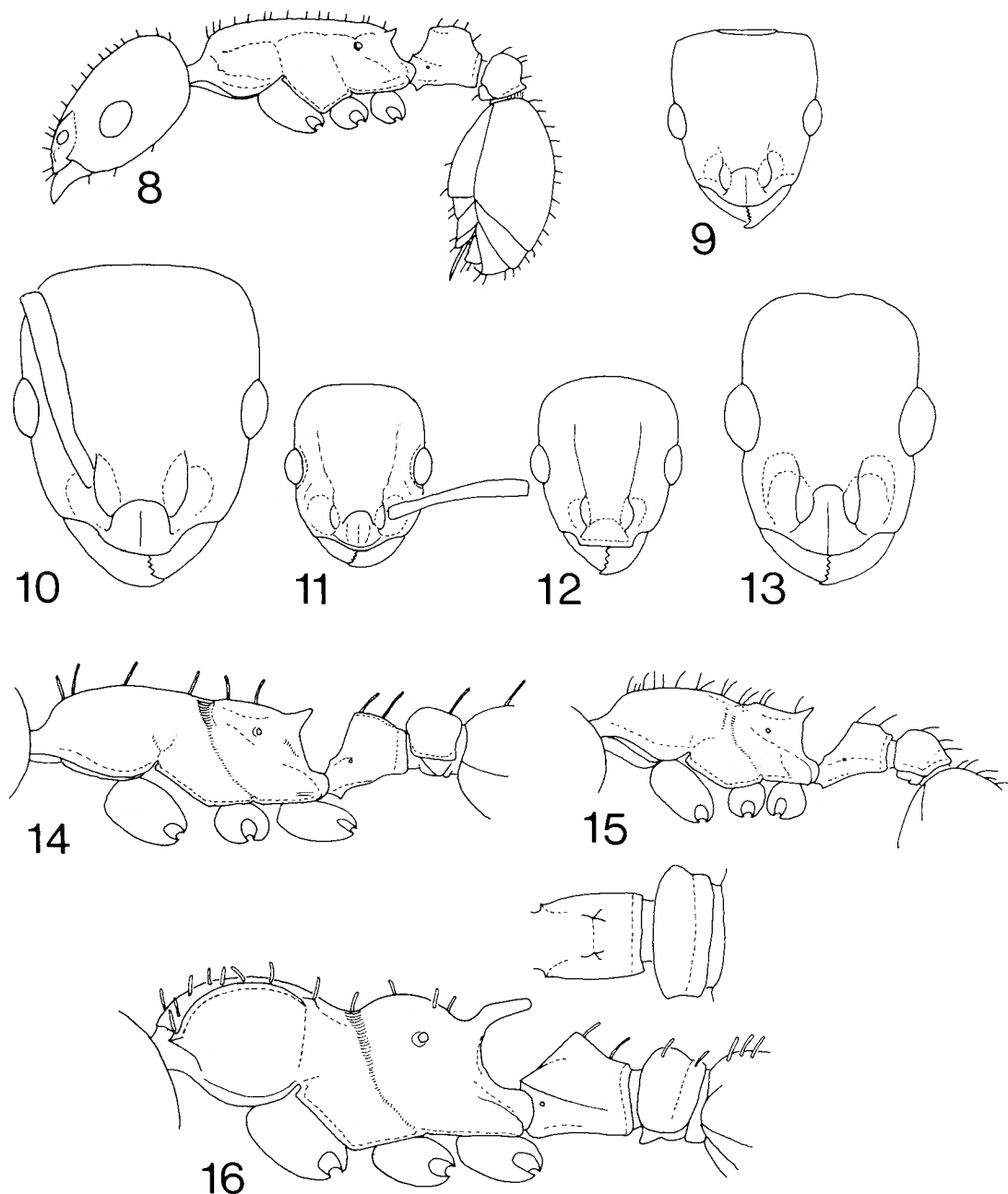
(Figs 8–22)

- Leptothorax* Mayr, 1855: 431. Type-species: *Formica acervorum* F., 1793: 358, by subsequent designation of Bingham, 1903: 214.
- Temnothorax* Mayr, 1861: 68. Type-species: *Myrmica (Leptothorax) recedens* Nylander, 1856: 94, by monotypy. [Synonymy by Forel, 1890a: lxxii.]
- Dichothorax* Emery, 1895b: 323 [as subgenus of *Leptothorax*]. Type-species: *Leptothorax (Dichothorax) pergandei* Emery, 1895b: 323, by subsequent designation of Wheeler, 1911: 161. [Synonymy by Brown, 1973: 180.]
- Goniothorax* Emery, 1896: 58 [as subgenus of *Leptothorax*]. Type-species: *Leptothorax vicinus* Mayr, 1887: 620, by subsequent designation of Wheeler, 1911: 164. [Junior homonym of *Goniothorax* Milne-Edwards, 1879: 103 (Crustacea).]
- Mychothorax* Ruzsky, 1904: 288 [as subgenus of *Leptothorax*]. Type-species: *Formica acervorum* F., 1793: 358, by original designation. [Synonymy by M. R. Smith, 1950: 29.]
- Nesomyrmex* Wheeler, 1910: 259. Type-species: *Nesomyrmex clavipilis* Wheeler, 1910: 259, by monotypy. [As subgenus of *Leptothorax* and first available replacement name for *Goniothorax* Emery; M. R. Smith, 1950: 30.] **Syn. n.**
- Tetramyrma* Forel, 1912: 766 [as subgenus of *Dilobocondyla* Santschi]. Type-species: *Dilobocondyla (Tetramyrma) braunsi* Forel, 1912: 767, by monotypy. [Raised to genus; Forel, 1913b: 122. See also Bolton, 1976: 291.] **Syn. n.**
- Caulomyrma* Forel, 1914: 233 [as subgenus of *Leptothorax*]. Type-species: *Leptothorax echinatinodis* Forel, 1886a: xlviii, by original designation. [Synonymized with *Nesomyrmex* by Forel, 1915: 364.]
- Myrmammophilus* Menozzi, 1924: 29 [as subgenus of *Leptothorax*]. Type-species: *Leptothorax (Myrmammophilus) finzii* Menozzi, 1924: 29, by monotypy. [Synonymy by Brown, 1973: 182.]
- Limnomyrme* Arnold, 1948: 222. Type-species: *Limnomyrme stramineus* Arnold, 1948: 223, by original designation. [Synonymized with *Nesomyrmex* by Brown, 1971: 4.]
- Myrafant* M. R. Smith, 1950: 29 [as subgenus of *Leptothorax*]. Type-species: *Leptothorax curvispinosus* Mayr, 1866: 508, by original designation. [Synonymy by Brown, 1973: 182.]
- Icothorax* Hamann & Klemm, 1967: 415 [as subgenus of *Leptothorax*]. Type-species: *Leptothorax (Icothorax) megalops* Hamann & Klemm, 1967: 417, by monotypy. [Synonymized with *Myrafant* by Urbani, 1978: 556.]

**DIAGNOSIS OF WORKER.** Monomorphic myrmicine ants. Mandibles usually with five teeth (very rarely with 6) which decrease in size from apex to base. Palp formula 5, 3 (60 species examined by dissection or *in situ* count). Median portion of clypeus unmodified, broad and broadly inserted between the frontal lobes. Anterior margin of median portion of clypeus evenly arched-convex to strongly lobate, the lobe often prominent and concealing the basal border of the mandible or the basal tooth. Lateral portions of clypeus unmodified, not forming a raised narrow ridge or shield-wall in front of the antennal insertions. Frontal carinae usually absent but very rarely represented by a pair of faint narrow lines which run back from the ends of the narrow frontal lobes. Antennal scrobes absent. Antennae with 11–12 segments, with a conspicuous 3-segmented apical club. Eyes present, moderate to large in size and situated at or slightly in front of the midlength of the sides. Propodeal spiracle circular and frequently very small, situated usually at about the midlength of the segment and generally quite high up on the sides; never shifted back and down to a position close to the bases of the propodeal spines. Pronotal corners dentate to evenly rounded. Metapleural lobes rounded, usually small. Metanotal groove varying from absent to deeply impressed. Propodeum commonly bidentate or bispinose, only very rarely unarmed. Petiole nodiform, variable in shape, the anterior peduncle very variable in length and often with a denticulate process on each side dorsally where peduncle meets node. Sting strong and acute, without apical or apicodorsal lamelliform appendages, roughly cylindrical in section, not knife blade-like. Pilosity usually of short stout blunt hairs but sometimes hairs absent and sometimes elongate.

*Leptothorax* is a large genus with a worldwide distribution although the majority of species are Holarctic. Over 200 species have been described to date of which just 11 occur in sub-Saharan

Africa. The reason for this paucity of species in the Afrotropical region may well be the result of direct competition from the extremely varied and enormously successful tetramoriine fauna of the region (Bolton, 1976; 1980). In the past some members of *Leptothorax* and *Tetramorium* have been confused because of an overall convergent similarity of appearance between a few members of each genus. The following table will separate the workers of the two genera.



**Figs 8–16** *Leptothorax* workers. 8, profile of *angulatus*. 9–13, heads of (9) *angulatus*, (10) *braunsi*, (11) *cenatus*, (12) *humerosus*, (13) *megalops*. 14–16, alitrunk and pedicel segments of (14) *megalops*, (15) *cenatus*, (16) *humerosus*. Pilosity omitted in 9–13.

*Leptothorax*

Sting simple, without an apical or apicodorsal lamelliform appendage.

Maxillary palp with 5 segments.

Lateral portions of clypeus not raised into a narrow ridge or shield-wall in front of the antennal insertions.

Mandibles with 5 (rarely 6) teeth, decreasing in size from apex to base.

Propodeal spiracle set high on side of segment and about at its midlength; the spiracle usually in the anterodorsal quadrant of the side of the propodeum.

*Tetramorium*

Sting with an apical or apicodorsal lamelliform appendage.

Maxillary palp with 4 (or rarely 3) segments.

Lateral portions of clypeus raised into a narrow ridge or shield-wall in front of the antennal insertions.

Mandibles usually with 7 teeth arranged as three enlarged teeth followed by 4 denticles. [One or two species with only 6 teeth but several with > 7 by increase of the denticle series.]

Propodeal spiracle shifted back and down, set behind the midlength; the spiracle usually in the posteroventral quadrant of the side of the propodeum.

Apart from the few African species revised below the taxonomy of most of the Old World fauna of *Leptothorax* is in a poor condition. Only the faunas of North America (Creighton, 1950; Brown, 1955) and of the Neotropical region (Kempf, 1959; Urbani, 1978) have been studied in any detail. The west European fauna is mostly covered by Bernard (1968), Collingwood (1978; 1979) and Kutter (1977) but the remainder of the Old World remains unstudied by modern methods.

Most of the generic synonymy noted above is straightforward and needs no further comment here; a few, however, require further explanatory notes, as follows.

*Temnothorax*, synonymized long ago by Forel (1890a) on the grounds that it graded into *Leptothorax*, has frequently been resurrected by European authors and treated either as a subgenus of *Leptothorax* or even as a separate genus (most recently by Bernard, 1968). The reason for this is not hard to find for among the west European species *recedens*, the type-species of *Temnothorax*, stands out as an oddity as it does not belong to any of the usual west European species-groups. However, when the extensive North African fauna is considered *recedens* is seen as a fairly unexceptional *Leptothorax* species, and when the world fauna is taken into consideration it seems decidedly mundane. The truth of the matter appears to be that *recedens*, along with a few other species, really belongs to the North African fauna but has managed to establish itself north of the Mediterranean. Urbani (1971) has discussed the validity of *Temnothorax* and concluded that Forel's approach was the only logical one. I agree completely and thus the original synonymy of Forel stands.

*Tetramyrma*, originally described as a subgenus of *Dilobocondyla* and later transferred into the Tetramoriini, was recognized by Bolton (1976) to be only dubiously separable from *Leptothorax*. On closer study it has not proved possible to find any genus-level characters to keep the name separate. The type-species of *Tetramyrma*, *braunsi*, seems odd at first sight because of its domed petiole and rounded, unarmed propodeum, but these developments are foreshadowed in *maximus* Santschi and its allies. *L. simoni*, the only other species ever placed in *Tetramyrma*, provides a good link back into the main mass of *Leptothorax* species, showing as it does a pair of propodeal teeth whilst otherwise resembling *braunsi* very closely.

*Nesomyrmex*, with its own set of earlier synonyms (*Caulomyrma*, *Goniothorax*, *Limnomyrmex*), is here formally synonymized with *Leptothorax* for the first time. Brown (1973) placed it as a possible synonym in his world list of genera. Some members of this predominantly tropical group appear very odd as a number of them have the petiole node denticulate, others have dentate pronotal corners and many have very prominent clypeal lobes. However, there do not appear to be any characters, either alone or in combination, which can serve to keep the former *Nesomyrmex* species separate from the mass of *Leptothorax*. The largest representation of this group occurs in South America and has been revised by Kempf (1959). His definition does not separate *Nesomyrmex* from *Leptothorax* and one of his stated characters, the 5,3 palp formula, seems universal in the genus. Species formerly placed in *Nesomyrmex* show considerable variation in form and grade into more ordinary *Leptothorax* in all their specialized characters.

In my opinion all the earlier synonymy quoted above is valid and none of the included names is deserving of further recognition as none of the characters invoked to separate them is consistent or particularly functional. In fact, the similarities so enormously outweigh the supposed differences, and the assumed diagnostic characters are so variable both within and between the supposed subgenera, that the subgeneric system used in *Leptothorax* was at best artificial, at worst misleading.

The only remaining subgeneric name in *Leptothorax* is *Macromischa* Roger (= *Antillaemyrmex* Mann, = *Croesomyrmex* Mann). Until recently this was treated as a good genus but Urbani (1978), in his revision of the group, showed that the more exotic species (formerly in *Macromischa*) graded into the more ordinary *Leptothorax* groups without it being possible to draw any meaningful dividing line. However, instead of sinking *Macromischa* he chose to treat it as a subgenus, though with considerable apprehension as some of the characters used are also demonstrable, as Urbani says, elsewhere in *Leptothorax*, whilst others are not consistent through *Macromischa* itself. The implication is that *Macromischa* is best regarded as a synonym of *Leptothorax*.

The closest relatives of *Leptothorax* include many small inquiline or dulotic genera, all of which are derived directly from *Leptothorax*. These genera are *Chalepoxenus* Menozzi, *Harpagoxenus* Forel, *Epimyrmica* Emery, *Leonomyrma* Arnoldi, *Myrmoxenus* Ruzsky, *Doronomyrmex* Kutter, *Formicoxenus* Mayr, *Myrmetaerus* Soudek, and *Symmyrmica* Wheeler. Of these *Epimyrmica* is characterized by a reduced palp formula of 4,2 or 3,2 and usually a reduced dentition; the genus may be valid. *Harpagoxenus* and *Chalepoxenus* both have strong frontal carinae and short scrobes. The two are basically very similar and retain the standard leptothoracine palp formula count of 5,3. The difference of antennae 11-segmented versus 12-segmented which is used to separate them is not convincing as both antennomere counts occur in *Leptothorax* (and several other myrmicine genera). The relationship of these two needs further study for, although *Chalepoxenus* was revised quite recently (Kutter, 1973) its standing with relation to *Harpagoxenus* was not discussed. The older separation based on mandibular dentition, with *Chalepoxenus* having dentate and *Harpagoxenus* edentate mandibles works for Europe, but the North American *Harpagoxenus* species have teeth.

*Doronomyrmex*, with its two parasitic species *pacis* Kutter and *pocahontas* Buschinger, seems indefensible as a genus. Its specialized features all result from inquiline syndrome characters common to numerous parasitic but otherwise unrelated ants. The same appears to be true of *Myrmetaerus* and *Myrmoxenus*, although further study of all these is needed. More information is also required of *Leonomyrma* and *Symmyrmica* as both genera have short but fairly prominent frontal carinae. The former also has the eyes shifted back on the head and the latter has 6-dentate mandibles although this is not unknown in *Leptothorax*.

Finally *Formicoxenus*. Because of their very specialized inquiline lifeways in the nests of much larger formicine ants *Formicoxenus* species have always presented a problem. Until recently the genus only contained the two Palaearctic species *nitidulus* (Nylander) and *orientalis* Dlussky, and was separated from *Leptothorax* by its possession of a strongly dentate subpostpetiolar process. This postpetiolar development is a common feature in many unrelated inquilines from all parts of the Myrmicinae and is a recognized character of the inquiline syndrome. It should not, by itself, be regarded as being of generic significance. Dissection of *nitidulus* has, however, shown that the mandibles are apparently consistently 6-dentate and the palp formula is reduced to 4,3. These characters, coupled with the 11-segmented antennae (again not a strong character when taken alone) combine to form a reasonable case for maintaining *Formicoxenus* as a genus. An observation in support of this comes from the decision of Buschinger (1979) to transfer the American species *hirticornis* Emery and *diversipilosus* M. R. Smith from *Leptothorax* to *Formicoxenus* on the grounds that their social organization is the same as in the European *nitidulus*, and despite the fact that they lack a strong subpostpetiolar process. Dissection of *hirticornis* has shown a 4,3 palp formula and 6-dentate mandibles as in *nitidulus*. I have not been able to dissect any *diversipilosus* but a similar dentition and palp formula there would reinforce the case for maintaining *Formicoxenus* as a genus separate from *Leptothorax*.



Synonymic list of Afrotropical *Leptothorax* species*angulatus* Mayr*angulatus* st. *ilgii* Forel syn. n.*latinodis* Mayr syn. n. (provisional)*angulatus* var. *concolor* Santschi syn. n.*braunsi* (Forel) comb. n.*cenatus* sp. n.*denticulatus* Mayr*evelynae* Forel*grisoni* Forel*humerosus* Emery*innocens* (Forel)*megalops* Hamann & Klemm*simoni* (Emery) comb. n.*stramineus* (Arnold)

## Key to species (workers)

- 1 With the alitrunk in absolute profile the dorsum forming a single uninterrupted surface which is evenly flat or slightly convex, without trace of a metanotal impression and not having the propodeum depressed (Fig. 8) . . . . . 2
- With the alitrunk in absolute profile the dorsum with the metanotal groove impressed even if only feebly so, or the propodeum depressed below the level of the promesonotum, or both (Figs 14–22) . . . . . 3
- 2 Head and body uniform blackish brown to black. (Ghana, Zaire) . . . . . *grisoni* (p. 329)
- Head and body uniform yellow. (Extremely widespread) . . . . . *angulatus* (p. 324)
- 3 First gastral tergite everywhere with blunt standing hairs . . . . . 4
- First gastral tergite either without standing hairs at all or at most with a single transverse row at the apex of the sclerite . . . . . 9
- 4 Petiole node narrow in profile, not denticulate (Figs 14–16). Antennal scapes longer, SI 85–110. Eyes larger, maximum diameter 0.30–0.38 × HW . . . . . 5
- Petiole node broad in profile, denticulate (Figs 18–20). Antennal scapes shorter, SI 68–74. Eyes smaller, maximum diameter 0.24–0.29 × HW . . . . . 7
- 5 Anterior pronotal angles projecting as a pair of acute teeth in dorsal view; sides of pronotum sharply marginate. Petiole node sharply triangular in profile (Fig. 16). Scapes relatively shorter and head broader (Fig. 12), SI 85, CI 83. ('East Africa') . . . . . *humerosus* (p. 329)
- Anterior pronotal angles evenly bluntly rounded in dorsal view; sides of pronotum not marginate. Petiole node not sharply triangular in profile (Figs 14, 15). Scapes relatively longer and head narrower (Figs 11, 13), SI 107–110, CI 70–78 . . . . . 6
- 6 Eyes larger, maximum diameter 0.38 × HW. Petiole node in profile without a strongly differentiated posterodorsal angle (Fig. 14). Mandibles almost smooth, with only vestiges of sculpture. (Sudan) . . . . . *megalops* (p. 331)
- Eyes smaller, maximum diameter 0.30–0.31 × HW. Petiole node in profile with a strongly differentiated posterodorsal angle (Fig. 15). Mandibles with strong but fine longitudinal rugular sculpture. (Kenya) . . . . . *cenatus* (p. 327)
- 7 Subpetiolar process a tooth anteriorly followed by a long cuticular flange which runs back to the postpetiolar junction (Fig. 19). Eyes with 10–11 ommatidia in the longest row. Larger species, HW 0.62–0.68, PW 0.46–0.52. (South Africa) . . . . . *denticulatus* (p. 328)
- Subpetiolar process an anteriorly situated simple tooth or denticle (Figs 18, 20). Eyes with 7–8 ommatidia in the longest row. Smaller species, HW 0.49–0.53, PW 0.35–0.38 . . . . . 8
- 8 Propodeal spines short and broad, in profile about as long as their basal width, the declivity between the spines and the metapleural lobes concave (Fig. 20). Dorsum of head densely and sharply reticulate-punctate, with traces of fine rugulae. (Zaire) . . . . . *innocens* (p. 330)
- Propodeal spines long and narrow, in profile distinctly longer than their basal width and slightly downcurved, the declivity between the spines and the metapleural lobes straight (Fig. 18). Dorsum of head weakly superficially reticulate-punctate, without trace of rugulae. (South Africa) . . . . . *stramineus* (p. 332)
- 9 Propodeum unarmed (Fig. 22). (South Africa) . . . . . *braunsi* (p. 325)
- Propodeum armed with a pair of spines or teeth (Figs 17, 21) . . . . . 10

- 10 Eye with only 7–8 ommatidia in the longest row. Alitrunk shaped as in Fig. 17. Small yellow species with longer scapes, HW < 0.60, SI > 90. (Ghana, Zaire) . . . . . *evelynae* (p. 328)  
 – Eye with 15–16 ommatidia in the longest row. Alitrunk shaped as in Fig. 21. Large reddish species with darker gaster and shorter scapes, HW > 0.85, SI < 85. (South Africa) . . . . . *simoni* (p. 331)

The few species constituting the Afrotropical fauna of *Leptothorax* apparently represent outliers derived from a number of different species-groups of extralimital origin, one or two species from each of which have managed to enter the region and to survive there. Because of the unsatisfactory state of the taxonomy of *Leptothorax* the species-group limits have not been worked out, but the 11 species occurring in sub-Saharan Africa aggregate as follows.

*L. angulatus* and *grisoni*. Metanotal groove absent. SI > 85. Eyes large, with 15 or more ommatidia in the longest row. Pronotal corners acute. Petiole node large, with a short anterior peduncle; the node sculptured but not denticulate. Frontal carinae absent. Median clypeal lobe more or less evenly convex.

*L. denticulatus*, *innocens* and *stramineus*. Metanotal groove present. SI < 75. Eyes relatively small, with 7–10 ommatidia in the longest row. Pronotal corners blunt. Petiole node large and denticulate, with a moderately long anterior peduncle. Frontal carinae absent and the median clypeal lobe more or less evenly convex.

*L. braunsi* and *simoni*. Metanotal groove present and the propodeum somewhat depressed below the level of the promesonotum. SI in intermediate range, 78–83. Eyes large, with 16–18 ommatidia in the longest row. Pronotal corners rounded. Petiole node massive and domed, not denticulate and with a moderately long narrow peduncle. Clypeal lobe conspicuously produced; frontal carinae absent.

*L. evelynae*, *cenatus* and *megalops*. Metanotal groove present but shallow, sometimes very shallow. SI > 90. Eyes relatively small to moderate, with 7–12 ommatidia in the longest row. Pronotal corners bluntly angular to evenly rounded. Petiole node small, without denticles and with a moderately long peduncle. Frontal carinae very feeble to absent and the median clypeal lobe more or less evenly rounded.

*L. humerosus*. Metanotal groove present. SI 85. Eyes large, with 14–15 ommatidia in the longest row. Pronotal corners sharply dentate, the sides of the pronotum sharply marginate. Petiole node acutely triangular, not denticulate, with a short peduncle. Feeble frontal carinae present and the median clypeal lobe conspicuously produced.

### *Leptothorax angulatus* Mayr

(Figs 8, 9)

*Leptothorax angulatus* Mayr, 1862: 739. LECTOTYPE worker, EGYPT: 'auf der sinaitischen Halbinsel' (R. v. Frauenfeld) (NM, Vienna), here designated [examined].

*Leptothorax angulatus* st. *ilgii* Forel, 1894: 82. Holotype worker, ETHIOPIA: 'Sudabessinien' (A. Ilg) (MHN, Geneva) [examined]. **Syn. n.**

*Leptothorax latinodis* Mayr, 1895: 130. Holotype worker, MOZAMBIQUE: Delagoa Bay (*H. Brauns*) (not found, presumed lost). **Syn. n.** (provisional).

*Leptothorax angulatus* var. *concolor* Santschi, 1914a: 107, fig. 15. Syntype workers, KENYA: Mombasa, st. no. 3, x.1911 (*Alluaud & Jeannel*) (NM, Basle) [examined]. **Syn. n.** [Data labels on syntypes read *L. (Goniothorax) angulatus* var. *concolor*.]

WORKER. TL 3.1–3.8, HL 0.70–0.90, HW 0.56–0.74, CI 75–85, SL 0.50–0.66, SI 88–97, PW 0.40–0.56, AL 0.82–1.08 (65 measured).

Mandibles delicately but densely longitudinally striate, the striation usually distinct but sometimes superficial. Median clypeal lobe extensive, broad, covering the bases of the mandibles and having its anterior margin conspicuously arched-convex. Median clypeal carina fine, not strongly developed but usually discernible, only rarely the carina partially or wholly effaced. Antennal scrobes absent. Frontal carinae absent but in some the frontal lobe followed on one or both sides by a weak regular line which runs back on the head. Maximum diameter of eyes 0.17–0.22, about 0.27–0.33 × HW and with 13 or more ommatidia in the longest row. With the head in full-face view the sides narrower in front of the eyes than behind, slightly convergent anteriorly. Sides of head behind eyes shallowly convex, slightly convergent posteriorly and meeting the occipital margin in a blunted angle. Occipital margin transverse to very shallowly concave, with a slightly projecting rim above the occipital foramen which is visible in full-face view. With the alitrunk in profile the dorsum forming a single shallowly convex to almost flat surface, without trace of a metanotal impression. Propodeum armed with a pair of triangular teeth or short broad spines of variable size. In general the teeth are about as long as their basal width and slightly upcurved, but individuals with spines

longer than their basal width are fairly common. Specimens with the propodeal armament reduced to short broad teeth, where they are shorter than the basal width, are less common. Metapleural lobes low and rounded. In dorsal view the alitrunk with angulate to weakly dentate pronotal corners. Mesonotum narrower than pronotum and the sides of the propodeum diverging to the level of the spiracle and then converging to the bases of the propodeal teeth. Petiole in profile shaped as in Fig. 8, with a short anterior peduncle which has a triangular dentiform anteroventral process. Dorsal surface of peduncle with a denticulate process in front of the level of the spiracle on each side. Anterodorsal angle of node quite sharply defined, the posterodorsal angle much broader and bluntly rounded. Petiole node in dorsal view variable in shape and size. Usually the node about as broad as long, rarely slightly longer than broad but quite commonly obviously broader than long, in some cases approaching the postpetiole in width. Dorsum of head covered with a fine dense reticulate-punctulate ground-sculpture which in some samples is superficial and granular in appearance. Superimposed on this are very fine irregular rugulae which frequently form a narrow reticulum occipitally and sometimes also on the sides of the head. Dorsal surfaces of alitrunk, petiole and postpetiole with fine granular or punctulate ground-sculpture and with disorganized fine rugulae. The rugular sculpture is usually distinctive but in some individuals may be partially effaced. Base of first gastral tergite generally with a superficial reticular pattern but sometimes almost completely smooth. All dorsal surfaces of head and body with numerous short stout blunt hairs; such hairs absent from the appendages. Colour yellow, frequently with the antennal club darker.

*L. angulatus* is the most widely distributed and commonest species of this genus in sub-Saharan Africa. It is easily identified by its yellow colour and lack of any trace of a metanotal groove or impression. Only one other species in the region lacks a metanotal groove, *grisoni*, but in this species the full adult colour is uniform blackish brown or black.

Arnold (1916: 259) noted that he only found *angulatus* on the trunks of trees but personal observation has shown that it also occurs in leaf litter samples and log mould. However, the species does seem to prefer to nest clear of the ground when possible, as colonies are often found in West Africa in cocoa pods which are still attached to the tree, and the sample from Malawi noted below was collected in *Swartzia* pods.

#### MATERIAL EXAMINED

**Egypt:** Sinai (*Frauenfeld*). **Ghana:** Legon (*D. Leston*); Tafo (*B. Bolton*); Tafo (*C. A. Collingwood*); Adeiso (*P. Room*); Adeiso (*D. Leston*). **Nigeria:** Gambari (*B. Taylor*). **Ethiopia:** 'Sudabessinien' (*A. Ilg*). **Sudan:** Equatoria (*N. A. Weber*); Port Sudan (*N. A. Weber*); Nile above Khartoum (*N. A. Weber*). **Kenya:** Nairobi (*Patrizi*); Mombasa (*Alluaud & Jeannel*); Tana Riv., Wema (*V. Mahnert & J.-L. Perret*). **Tanzania:** Dar es Salaam (*N. L. H. Krauss*). **Malawi:** nr Salima (*B. J. S.*). **Zimbabwe:** Victoria Falls (*G. Arnold*); Melsester (*G. Arnold*); Khami Riv. (*G. Arnold*). **Botswana:** Maxwee (*A. Russell-Smith*). **South Africa:** Natal, St Lucia (*J. C. Faure*).

#### *Leptothorax braunsi* (Forel) **comb. n.**

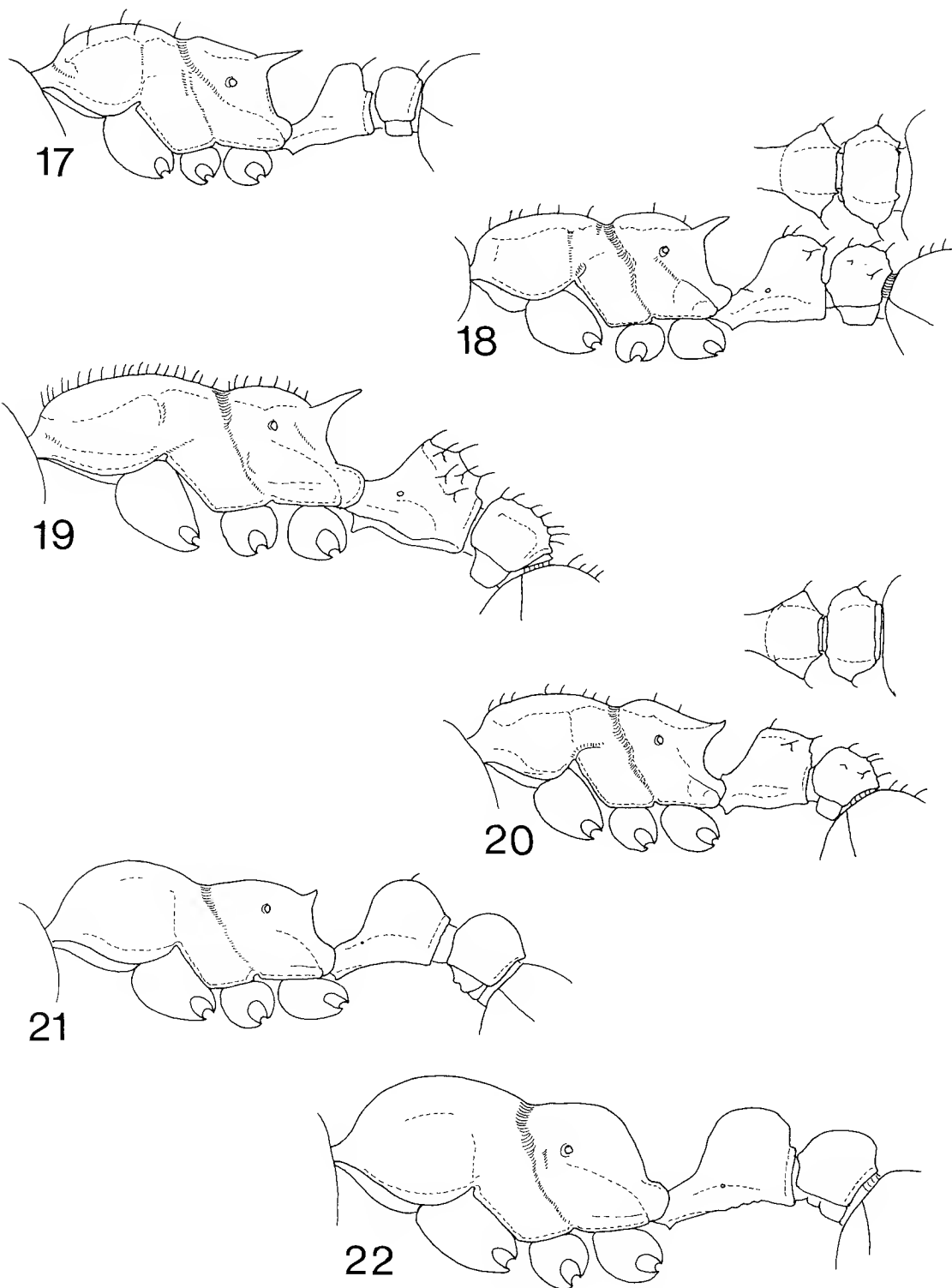
(Figs 10, 22)

*Dilobocondyla* (*Tetramyrma*) *braunsi* Forel, 1912: 767. Holotype worker, SOUTH AFRICA: Cape Colony, Willowmore (*H. Brauns*) (BMNH) [examined].

*Tetramyrma braunsi* (Forel) Forel, 1913b: 122. [See also Bolton, 1976: 291.]

**WORKER.** TL 5.2–5.9, HL 1.20–1.36, HW 1.00–1.16, CI 83–86, SL 0.82–0.94, SI 79–83, PW 0.78–0.96, AL 1.44–1.62 (9 measured).

Mandibles finely longitudinally striate, the spaces between striae finely punctulate or shagreened; the striate sculpture sometimes inconspicuous. Median lobe of clypeus prominent (Fig. 10), its anterior margin shallowly and evenly convex. Frontal carinae and antennal scrobes absent, the scapes of moderate length (SI above). Maximum diameter of eye 0.28–0.31, about 0.26–0.29 × HW and with 16–18 ommatidia in the longest row. In full-face view the head shaped as in Fig. 10. Alitrunk and pedicel segments in profile as in Fig. 22, the promesonotum evenly convex, the metanotal groove not or only slightly impressed but the propodeal dorsum distinctly depressed below the level of the promesonotum. Propodeum absolutely unarmed, the dorsum rounding evenly into the declivity. In dorsal view the pronotal corners rounded, the promesonotum narrowing posteriorly. Metapleural lobes rounded. Node of petiole in profile massive, with a relatively narrow anterior peduncle which has a dentiform anteroventral process. In dorsal view the petiole node subglobular, slightly broader than long; postpetiole broader than long and broader than the petiole. Dorsum of head longitudinally rugulose with a few cross-meshes, occipitally a weak reticulum may be



**Figs 17–22** *Leptothorax* workers. Alitrunk and pedicel segments of (17) *evelynae*, (18) *stramineus*, (19) *denticulatus*, (20) *innocens*, (21) *simoni*, (22) *braunsi*.

formed. Sides of head above and behind eyes generally more obviously reticulate than the dorsum. Dorsal alitrunk irregularly rugose, the sculpture quite strong, usually forming a reticulum on the propodeum and anterior pronotum. Petiole and postpetiole irregularly reticulate-rugose. First gastral tergite densely punctulate or shagreened, the sculpture generally strongest basally and usually traces of very fine longitudinal costulae may be seen. A few short inconspicuous erect hairs present on dorsum of head but the dorsal alitrunk, petiole and postpetiole hairless. First gastral tergite without standing hairs but with a short fine appressed sparse pubescence. Appendages without standing hairs. Head and gaster dark brown tinged with red to reddish black; alitrunk and pedicel segments red, the two colours strongly contrasting in fresh specimens.

This large and conspicuous South African species is easily recognized by its large size, unarmed propodeum, lack of hairs on alitrunk and first gastral tergite and depressed propodeal dorsum. The closest related species in sub-Saharan Africa is *simoni*, but here the propodeum is distinctly bidentate.

#### MATERIAL EXAMINED

**South Africa:** Cape Prov., Willowmore (*H. Brauns*).

### *Leptothorax cenatus* sp. n.

(Figs 11, 15)

HOLOTYPE WORKER. TL 3.6, HL 0.78, HW 0.60, CI 77, SL 0.64, SI 107, PW 0.47, AL 0.98.

Mandibles finely but strongly longitudinally rugulose. Anterior clypeal margin convex and concealing the basal tooth of the mandibles. Median clypeal carina feebly developed, weaker than the more laterally situated clypeal carinae, which converge anteriorly. The anteriormost clypeal carina runs across the clypeus in an unbroken transverse arc just behind the anterior margin, terminating at the antennal fossa on each side. Frontal carinae represented by a pair of feeble meandering rugula-like ridges which run back from the narrow frontal lobes to a point behind the level of the posterior margins of the eyes; these carinae scarcely stronger than the regular sculpture of the head and merging with that sculpture posteriorly. Antennal scrobes absent, the scapes relatively long, SI > 100. Eyes quite large, maximum diameter 0.18, about  $0.30 \times$  HW and with 11 ommatidia in the longest row. With the head in full-face view the occipital margin shallowly transversely convex, the occipital corners rounded. With alitrunk in dorsal view the pronotal corners rounded. With alitrunk in profile the promesonotum shallowly evenly convex, the metanotal area broadly but shallowly impressed and the propodeum armed with a pair of acute narrow spines. Metapleural lobes very low, rounded. Petiole in profile with a moderately long anterior peduncle, the dorsal surface of which is confluent with the anterior face of the node, the two not separated by an angle. Node with well developed antero- and posterodorsal angles, the dorsum between them more or less flat. In dorsal view the dorsum of the petiole node broader than long, and the petiole narrower than the postpetiole. Dorsum of head with fine, widely spaced, irregular rugulae which are predominantly longitudinal. Occipitally the rugulae are more sharply defined and have a few cross-meshes, although no reticulation is developed. Spaces between rugulae smooth or at most with only vestiges of ground-sculpture. Sides of head above eyes sculptured as dorsum but both in front of and behind the eyes the rugulae are more crowded and tend to form a loose reticulum. Promesonotal dorsum finely and predominantly longitudinally rugulose, with very sparse cross-meshes. The rugulae widely spaced and with a ground-sculpture of extremely fine superficial punctulae between them, which in places is almost effaced. Rugulae present on propodeal dorsum but weaker than on promesonotum. Petiole and postpetiole with fine superficial shagreening and a few weak inconspicuous rugulae. First gastral tergite unsculptured except for hair-pits. All dorsal surfaces of head and body with numerous stout blunt mainly straight hairs which are shorter and more erect on the head than on the first gastral tergite. Legs and scapes without such hairs. Dorsum of head brown, remainder of body dull yellow with a brown tint, especially on the petiole and postpetiole which are somewhat darker than the alitrunk and gaster but not as dark as the head.

PARATYPE WORKER. TL 3.2, HL 0.74, HW 0.58, CI 78, SL 0.62, SI 107, PW 0.42, AL 0.90.

As holotype but slightly smaller, maximum diameter of eye 0.18, about  $0.31 \times$  HW and with 10 ommatidia in the longest row.

Holotype worker, **Kenya:** Lake Nakuru, Nat. Park, 6.xi.1974, leaf litter (*V. Mahnert*) (MHN, Geneva).

Paratype. 1 worker, **Kenya:** Nakuru, Lake Elmenteita, 7.xi.1977, 1800 m (*V. Mahnert & J.-L. Perret*) (BMNH).

*L. cenatus* is closest related to *megalops* but differs in having smaller eyes and a differently shaped petiole node (compare Figs 11, 13 and 14, 15).

***Leptothorax denticulatus* Mayr**

(Fig. 19)

*Leptothorax denticulatus* Mayr, 1901: 5. Syntype workers, female, SOUTH AFRICA: Cape Prov., Port Elizabeth (*H. Brauns*) (NM, Vienna) [examined].

WORKER. TL 3.1–3.5, HL 0.74–0.84, HW 0.62–0.68, CI 81–85, SL 0.46–0.48, SI 71–74, PW 0.46–0.52, AL 0.82–0.94 (8 measured).

Mandibles finely shagreened to virtually smooth. Anterior margin of median lobe of clypeus evenly arched-convex; median clypeal carina present and usually quite distinct. Frontal carinae absent; antennal scrobes absent. Maximum diameter of eye 0.16–0.19, about  $0.26\text{--}0.29 \times \text{HW}$  and with 10–11 ommatidia in the longest row; the eye in profile only very slightly longer than high. With the head in full-face view the occipital margin straight to feebly convex, rounding evenly into the sides; the latter slightly narrower in front of the eyes than behind and feebly convergent anteriorly. With the alitrunk in profile the promesonotum shallowly convex dorsally, the metanotal groove impressed and the propodeal dorsum convex. Propodeum armed with a pair of strong spines which are longer than their basal width. Metapleural lobes rounded. In dorsal view the alitrunk with the pronotal corners bluntly angular to narrowly rounded. Petiole node in profile large and blocky (Fig. 19), the upper sides and dorsum with numerous peaks or denticles from which hairs arise. Peduncle of petiole short and broad, subtended by an extensive ventral process which takes the form of a triangular denticle or tooth anteriorly, followed by a long cuticular ridge which runs back to the junction with the postpetiole. In ventral view the subpetiolar ridge is seen to fork at about its midlength, forming an inverted Y-shape. With the pedicel segments in dorsal view the denticles conspicuous on the sides of both the petiole and postpetiole; both segments broader than long, the latter somewhat broader than the former. Dorsum of head covered with a blanket of fine dense punctulate ground-sculpture which is overlaid everywhere by dense and very fine rugular sculpture. On the dorsum the rugulae are close and longitudinal but on the sides, above the eyes and occipitally there is a tendency for a narrow reticulum to be formed. Dorsal alitrunk reticulate-punctate and with fine rugulae which are predominantly longitudinal; on the promesonotum a reticulum may be formed anteriorly and in some the rugulae are quite strongly developed. Sculpture of petiole and postpetiole dorsally predominantly reticulate-punctate but a few fine rugulae may be present. Base of first gastral tergite superficially reticulate to almost smooth. All dorsal surfaces of head and body densely and evenly clothed with short blunt hairs; the appendages without such hairs. Colour uniform yellow, sometimes the posterior half of the gaster darker than the anterior half.

Among the species in which the metanotal groove is impressed three, *denticulatus*, *innocens*, and *stramineus*, have the petiole node bearing denticles from which hairs arise. Of the three *denticulatus* is recognized by its strongly developed subpetiolar process, dense pilosity, larger eyes and larger size.

**MATERIAL EXAMINED**

**South Africa:** Cape Prov., Barrydale (*H. V. Daly*); Port Elizabeth (*H. Brauns*).

***Leptothorax evelynae* Forel**

(Fig. 17)

*Leptothorax (Goniothorax) evelynae* Forel, 1916: 423. Syntype workers, female, ZAIRE: St Gabriel (*Kohl*) (MHN, Geneva) [examined].

WORKER. TL 2.5–2.9, HL 0.58–0.70, HW 0.47–0.54, CI 77–81, SL 0.44–0.52, SI 92–98, PW 0.35–0.44, AL 0.65–0.82 (7 measured).

Mandibles finely shagreened. Median clypeal lobe evenly arched-convex. Median clypeal carina present but fine, incomplete in a few specimens. Frontal carinae and antennal scrobes absent. Antennal scapes relatively long,  $\text{SI} > 90$ . Maximum diameter of eye 0.12–0.16, about  $0.26\text{--}0.29 \times \text{HW}$  and with 7–8 ommatidia in the longest row. With the alitrunk in profile the metanotal groove shallowly but conspicuously impressed, the promesonotum evenly shallowly convex and the propodeal dorsum almost flat to shallowly convex. Propodeal spines straight, distinctly longer than their basal width. Metapleural lobes

low and rounded. In dorsal view the alitrunk with the pronotal corners angulate and the sides of the promesonotum bluntly marginate. The dorsal surface gradually narrows from front to back but the sides of the mesonotum are slightly convex and the sides of the propodeum diverge from the metanotal groove to the level of the spiracle and then converge to the bases of the spines. Petiole in profile with a high narrow node (Fig. 17) which is not equipped with denticles. Ventral process of peduncle a simple small tooth, anteriorly situated. In dorsal view the petiole node broader than long. Dorsum of head with fine superficial reticulate-punctate ground-sculpture which is overlaid by a very fine narrow reticulate-rugulose net everywhere except in the area immediately behind the frontal lobes. Dorsal alitrunk with superficial punctulate ground-sculpture overlaid by fine rugulae. In specimens from Zaire this regular sculpture is faint and weakly developed, forming a reticulum only on the anterior pronotum, but in material from Ghana the rugulae are more strongly developed everywhere and reticular meshes are frequent. Petiole and postpetiole finely punctulate or granular dorsally, sometimes with one or two fine rugulae. Base of first gastral tergite very lightly shagreened or with a superficial reticular pattern. Dorsum of head with scattered short stout blunt hairs. Similar hairs are present on the pronotum (several pairs), mesonotum (1–3 pairs), petiole and postpetiole (1–2 pairs each) but are absent from the propodeum and absent from the first gastral tergite except for a transverse row at the extreme apex. Gastral segments behind the first also with a transverse apical row each. Colour yellow.

The characteristic distribution of the body hairs renders *evelynae* quickly recognizable among the African *Leptothorax* species. The lack of hairs on the propodeum and first gastral tergite is paralleled only in *simoni* and *braunsi*, but these are both much larger (HW > 0.85), darker coloured species with much more massively developed petiole nodes and shorter antennal scapes (SI < 85). The closest related species appears to be *megalops*, but here the eyes are larger and the propodeum and first gastral tergite both have hairs present.

#### MATERIAL EXAMINED

**Ghana:** Tafo (*B. Bolton*). **Zaire:** St Gabriel (*Kohl*).

### *Leptothorax grisoni* Forel

*Leptothorax* (*Goniothorax*) *grisoni* Forel, 1916: 425. Syntype workers, male, ZAIRE: St Gabriel (*Kohl*) (MHN, Geneva; MCZ, Cambridge) [examined].

WORKER. TL 2.9–3.4, HL 0.76–0.86, HW 0.60–0.66, C1 77–81, SL 0.56–0.63, SI 94–98, PW 0.46–0.53, AL 0.85–1.02 (9 measured).

Answering to the description of *angulatus*, differing only in colour and intensity of sculpture. In *grisoni* the full adult colour is uniform blackish brown to black, as opposed to the uniform yellow found in *angulatus*. The dorsum of the head and alitrunk in *grisoni* is blanketed by a dense reticulate-punctate ground-sculpture which is overlaid by conspicuous fine rugulae which form a distinct reticulum on the alitrunk and on much of the head. Basically this sculpture is the same as that seen in *angulatus*, but here it is more intensely and sharply developed.

Although these seem relatively minor differences I am prepared to accept them as valid for the present. The reason for this is that the two colour forms have ranges which only partially overlap. The yellow *angulatus* is known from most of the continent from Ethiopia and Sudan to South Africa and Botswana, but the dark *grisoni* has only been found in Ghana and Zaire. *L. angulatus* also occurs in Ghana in the same areas where *grisoni* has been discovered, but even here the two maintain their distinctive colours, no intermediates being known.

#### MATERIAL EXAMINED

**Ghana:** Tafo (*B. Bolton*); Kade (*J. Majer*); Asamankese (*P. Room*). **Zaire:** St Gabriel (*Kohl*).

### *Leptothorax humerosus* Emery

(Figs 12, 16)

*Leptothorax humerosus* Emery, 1896: 62. Holotype worker, 'AFRICA ORIENTALE': no loc. (*Staudinger & Bang-Haas*) (MCSN, Genoa) [examined].

WORKER. TL 3.7, HL 0.90, HW 0.75, C1 83, SL 0.64, SI 85, PW 0.52, AL 0.98.

Mandibles almost smooth, with only vestigial traces of superficial sculpture. Median lobe of clypeus strongly produced, roughly rectangular, its anterior margin transverse and flat; the anterior margin meeting the sides of the lobe in a distinct angle. Median clypeal carina absent. Narrow weakly differentiated frontal carinae present which are scarcely stronger than the remaining cephalic sculpture but which reach back well beyond the level of the posterior margins of the eyes. Antennal scrobes absent. Antennal scapes moderately long, SI 85. Maximum diameter of eye 0.24, about  $0.32 \times \text{HW}$  and with 14–15 ommatidia in the longest row. With the head in full-face view the sides narrower in front of the eyes than behind and somewhat convergent anteriorly. Sides behind eyes rounding evenly into the occipital margin, the latter shallowly and evenly transversely convex. Pronotum sharply marginate laterally, the anterior pronotal corners dentate. With the alitrunk in profile the promesonotum convex, the metanotal groove deeply impressed. Propodeum broadly and evenly convex in profile, sloping down posteriorly to the long spines; the latter blunt apically and with their dorsal margins angled (Fig. 16). Metapleural lobes low and rounded. Petiole in profile with the node triangular, rising to an acute peak above; anterior peduncle of petiole short. In dorsal view the sides of the petiole roughly parallel. Postpetiole much broader than petiole. Basal face of first gastral tergite transverse except for a median concavity where it articulates with the postpetiole. Dorsum of head everywhere sculptured with fine longitudinal rugulae and with a fine granular to punctulate superficial ground-sculpture. Dorsal alitrunk with ground-sculpture similar to head. Pronotum also with 7–8 broad, coarse longitudinal rugae which are almost sulcate in appearance and are most strongly developed anteriorly. These longitudinal rugae are continuous over the length of the promesonotum and also traverse the base of the metanotal groove, but they either fade out or become very weakly defined on the propodeum where a punctulate ground-sculpture predominates. Petiole and postpetiole finely and densely reticulate-punctulate, the first gastral tergite very densely finely shagreened and opaque. All dorsal surfaces of head and body with distinctive short stout blunt hairs. Body colour more or less uniform medium brown but the mandibles, clypeal lobe and antennae yellow. Propodeal spines yellowish, lighter in colour than the propodeum itself.

This very distinctive species is easily separable from all other known African forms by its flat-margined clypeal lobe, deep metanotal groove, large eyes, sharply marginate pronotum with dentate corners and sharply triangular petiole node. It is not obviously related to any other species of *Leptothorax* in the region and, as far as is known, is only represented in collections by the holotype.

#### MATERIAL EXAMINED

'East Africa': no loc. (*Staudinger & Bang-Haas*).

### *Leptothorax innocens* (Forel)

(Fig. 20)

*Tetramorium* (*Leptothorax*?) *innocens* Forel, 1913a: 317. Holotype worker, ZAIRE: Katanga, Elizabethville (= Lubumbashi) (*Bequaert*) (MHN, Geneva) [examined].

*Leptothorax innocens* (Forel) Forel, 1916: 425.

WORKER. TL 2.3–2.5, HL 0.60–0.62, HW 0.49–0.50, CI 81–82, SL 0.34–0.35, SI 69–70, PW 0.35–0.36, AL 0.66–0.68 (2 measured).

Mandibles extremely finely and delicately superficially shagreened, almost smooth. Median portion of clypeus with anterior margin evenly arcuate-convex, with a narrow cuticular apron. Median clypeal carina vestigial to absent. Frontal carinae and antennal scrobes absent, the scapes short. Maximum diameter of eye 0.12–0.13, about  $0.24\text{--}0.26 \times \text{HW}$  and with 7–8 ommatidia in the longest row. With the head in full-face view the sides narrower in front of the eyes than behind and somewhat convergent anteriorly. Behind the eyes the sides very slightly convex and rounding into the occipital corners, the occipital margin itself very feebly impressed medially to almost straight. With the alitrunk in profile the promesonotum shallowly convex, the metanotal groove impressed and the propodeum convex, more strongly so than the promesonotum. Propodeal spines broadly triangular and stout, about as long as their basal width. Propodeal declivity concave between the spines and the rounded low metapleural lobes. In dorsal view the alitrunk with the pronotal shoulders obtusely and bluntly rounded, the promesonotum narrowing to the metanotal groove. Behind this the sides of the propodeum diverge to about the level of the spiracle, pass through an obtuse angle and then converge again to the bases of the spines. Petiole in dorsal view with a tubercle at either side of the node and the posterior margin of the node with a much smaller and inconspicuous pair of tubercles. Petiole in profile with a short anterior peduncle which has a small



triangular process ventrally. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely densely sharply reticulate-punctate, the promesonotum and head also with traces of fine rugular sculpture. First gastral tergite basally with very delicate superficial shagreening. All dorsal surfaces of head and body with numerous very short blunt hairs; legs and scapes without standing hairs. Colour uniform yellow.

This small species is closest related to *stramineus* but the two are separated by the characters given in the key and noted under the discussion of *stramineus*.

#### MATERIAL EXAMINED

**Zaire:** Katanga, Elizabethville (*Bequaert*).

### *Leptothorax megalops* Hamann & Klemm

(Figs 13, 14)

*Leptothorax (Icothorax) megalops* Hamann & Klemm, 1967: 417, fig. 1. Holotype worker, and paratype female, SUDAN: Wadi Halfa, 28.i.1962 (*H. Hamann & W. Klemm*) (NM, Vienna) [examined].

WORKER. TL 2.5, HL 0.67, HW 0.47, CI 70, SL 0.52, SI 110, PW 0.35, AL 0.72.

Mandibles almost smooth, with faint vestiges of superficial sculpture. Median lobe of clypeus prominent, its anterior margin evenly but shallowly convex. Median clypeal carina present, fine but distinct. Frontal carinae and antennal scrobes absent. Head relatively longer and narrower and scapes relatively longer than any other known species of the region (CI and SI above). Eyes relatively large, maximum diameter 0.18, about  $0.38 \times$  HW and with 11–12 ommatidia in the longest row. With the head in full-face view the occipital margin feebly indented medially, rounding broadly and evenly into the sides; the latter approximately parallel but converging slightly anteriorly. Alitrunk in profile with the metanotal groove shallowly impressed, the propodeal spines short, stout and straight. Metapleural lobes low and rounded, the declivity between the spines and the metapleural lobes more or less straight. In dorsal view the pronotal angles broadly and evenly rounded. Petiole in profile with the node bluntly triangular (Fig. 14), the anteroventral process small and triangular. Dorsum of head with fine longitudinal rugulae the spaces between which are smooth or at most only faintly superficially punctulate. Dorsal alitrunk with more conspicuous punctulate ground-sculpture which is overlaid by fine, predominantly longitudinal rugulae, although these are irregular in places. Petiole and postpetiole finely punctulate with traces of fine rugulae. First gastral tergite unsculptured. All dorsal surfaces of head and body with quite long blunt hairs which are, however, shorter on the head than on the alitrunk; the appendages without such hairs. Colour uniform yellow.

This very conspicuous species is easily recognized by its long narrow head, long scapes, large eyes, rounded pronotal corners and lack of denticles on the petiole node, coupled with its impressed metanotal groove and possession of hairs on the first gastral tergite. The closest relatives of *megalops* in the Afrotropical region are *evelynae* and *cenatus*. Both are distinguished from *megalops* quite easily as the former lacks pilosity on the first gastral tergite except for a sparse apical row, and the latter has strongly sculptured mandibles, smaller eyes and a broader head, and has the petiole node differently shaped (Figs 14, 15).

#### MATERIAL EXAMINED

**Sudan:** Wadi Halfa (*Hamann & Klemm*).

### *Leptothorax simoni* (Emery) **comb. n.**

(Fig. 21)

*Tetramorium simoni* Emery, 1895b: 35, pl. 2, fig. 22. Lectotype worker, SOUTH AFRICA: Transvaal, Makapan (*E. Simon*) (MCSN, Genoa), designated by Bolton, 1976: 292 [examined].

*Tetramyrma simoni* (Emery) Emery, 1922a: 291. [See also Bolton, 1976: 291.]

WORKER. TL 4.7, HL 1.10, HW 0.92, CI 84, SL 0.72, SI 78, PW 0.74, AL 1.32.

Mandibles with faint longitudinal sculpture and scattered pits. Median lobe of clypeus prominent, its anterior margin shallowly convex. Median clypeal carina distinct. Frontal carinae and antennal scrobes absent, the scapes of moderate length. Maximum diameter of eye 0.29, about  $0.32 \times$  HW and with 17–18 ommatidia in the longest row. With the head in full-face view the occipital margin shallowly convex centrally, more steeply convex laterally where it rounds into the sides. With the alitrunk in profile the promesonotum evenly convex, sloping down posteriorly to the shallow metanotal groove. Propodeal

dorsum more shallowly convex than the promesonotum and strongly depressed below the level of the promesonotum (Fig. 21). Propodeum armed with a pair of teeth which are slightly shorter than the rounded metapleural lobes. Petiole node massive, domed in profile, the anterior peduncle short and narrow, equipped with a dentiform anteroventral process. In dorsal view both petiole and postpetiole inflated, broader than long. Dorsum of head finely and predominantly longitudinally rugulose, with scattered cross-meshes. On the sides of the head and occipitally a loose reticulum is present. Ground-sculpture between the rugulae a fine dense punctulation, superficial in places. Dorsal surfaces of alitrunk, petiole and postpetiole reticulate-rugose, the meshes narrower and usually more sharply defined on the propodeum and pedicel segments than on the promesonotum. Fine punctulate ground-sculpture present everywhere but stronger on the pedicel segments than on the promesonotum. Base of first gastral tergite finely and very densely reticulate-punctulate, the sculpture weakening posteriorly on the sclerite. Extreme base of first tergite, just behind the postpetiolar articulation, with very short but strongly developed costulae. Short erect hairs very sparse on dorsum of head, absent from all other surfaces except the petiole where a single pair is present. Hairs absent from appendages. Sparse short decumbent to appressed pubescence present on alitrunk and first gastral tergite; hairs present on tergites of gaster behind the first. Head and gaster dark brown with a dull reddish tinge, alitrunk and pedicel segments dull red. Mandibles yellow.

A distinctive species characterized by its large size, depressed propodeum, lack of standing hairs on the first gastral tergite, large eyes and short propodeal teeth. The closest relative of *simoni* is *braunsi*, but in the latter the propodeum is unarmed (Figs 21, 22).

#### MATERIAL EXAMINED

**South Africa:** Transvaal, Makapan (*E. Simon*).

#### *Leptothorax stramineus* (Arnold)

(Fig. 18)

*Limnomyrmex stramineus* Arnold, 1948: 223, figs 10, 10a, 10b. Holotype worker, SOUTH AFRICA: Natal, Zululand, St Lucia Lake (*J. C. Faure*) (NM, Bulawayo) [examined].

*Leptothorax* (*Nesomyrmex*) *stramineus* (Arnold) Brown, 1971: 4.

WORKER. TL 2.8, HL 0.63, HW 0.53, CI 84, SL 0.36, SI 68, PW 0.38, AL 0.68.

Mandibles very delicately shagreened, almost smooth. Median portion of clypeus with anterior margin evenly arcuate-convex, with a very narrow cuticular apron. Median clypeal carina vestigial. Frontal carinae and antennal scrobes absent, the antennal scapes short. Maximum diameter of eye 0.13, about  $0.25 \times$  HW and with 7–8 ommatidia in the longest row. Sides of head behind eyes very feebly convex, the sides narrowing in front of the eyes so that the width immediately in front of the eyes is 0.47 and across the clypeus at its widest is 0.38 (compare with HW 0.53). Occipital margin approximately straight and the occipital corners evenly rounded. Alitrunk in profile with promesonotum evenly and shallowly convex, the propodeal dorsum on the same level but shorter and more strongly convex, the two convexities separated by the conspicuously impressed metanotal groove. Propodeal spines narrow and somewhat downcurved along their length, longer than their basal widths. Slope of the declivity between the spines and the rounded metapleural lobes straight. In dorsal view the alitrunk with the pronotal shoulders obtusely and bluntly angled, the promesonotum narrowing posteriorly to the metanotal groove. Behind this the propodeum broadening to the level of the spiracle then narrowing again to the bases of the spines; the latter divergent and in the holotype with the right spine slightly longer than the left. Petiole node in dorsal view with a strong lateral tubercle on each side, a pair of smaller tubercles on the posterior margin and a very feeble pair anterodorsally which are almost effaced. Postpetiole with a low but broad lateral tubercle on each side. In profile the petiole peduncle short, with a small triangular anteroventral process and with a very small sub-denticulate process dorsally. The node itself higher than long, the lateral and posterior tubercles distinct. Sides of first gastral tergite in dorsal view curving evenly away from the articulation with the postpetiole, without a sharp, flattened appearance. Head, alitrunk, petiole and postpetiole very finely and very densely superficially reticulate-punctulate, without rugulose sculpture. First gastral tergite with only the faintest vestiges of superficial sculpture basally. Dorsal surfaces of head and body with scattered very short blunt stout hairs; such hairs absent from appendages and sides of head but one or two may project from the curved part of the occipital corner on each side. Colour uniform pale yellow.

Among the species which have the metanotal groove impressed *stramineus* is most closely related to *innocens*, the two species sharing the characters of relatively small eyes and having short hairs on the first gastral tergite (as opposed to the first gastral tergite being hairless). In fact, *stramineus*

and *innocens* form an extremely close species-pair and may eventually prove to be expressions of a single species. For the present the two may be separated as the sculpture in *innocens*, although punctulate as in *stramineus*, is much more strongly developed and sharply defined, with traces of rugular sculpture also present at least on the head. Besides this the petiolar tubercles are not as strongly developed in *innocens* as they are in *stramineus*, and the propodeal spines are shorter and broader (Figs 18, 20).

#### MATERIAL EXAMINED

**South Africa:** Natal, St Lucia Lake (J. C. Faure).

### *MELISSOTARSUS* Emery

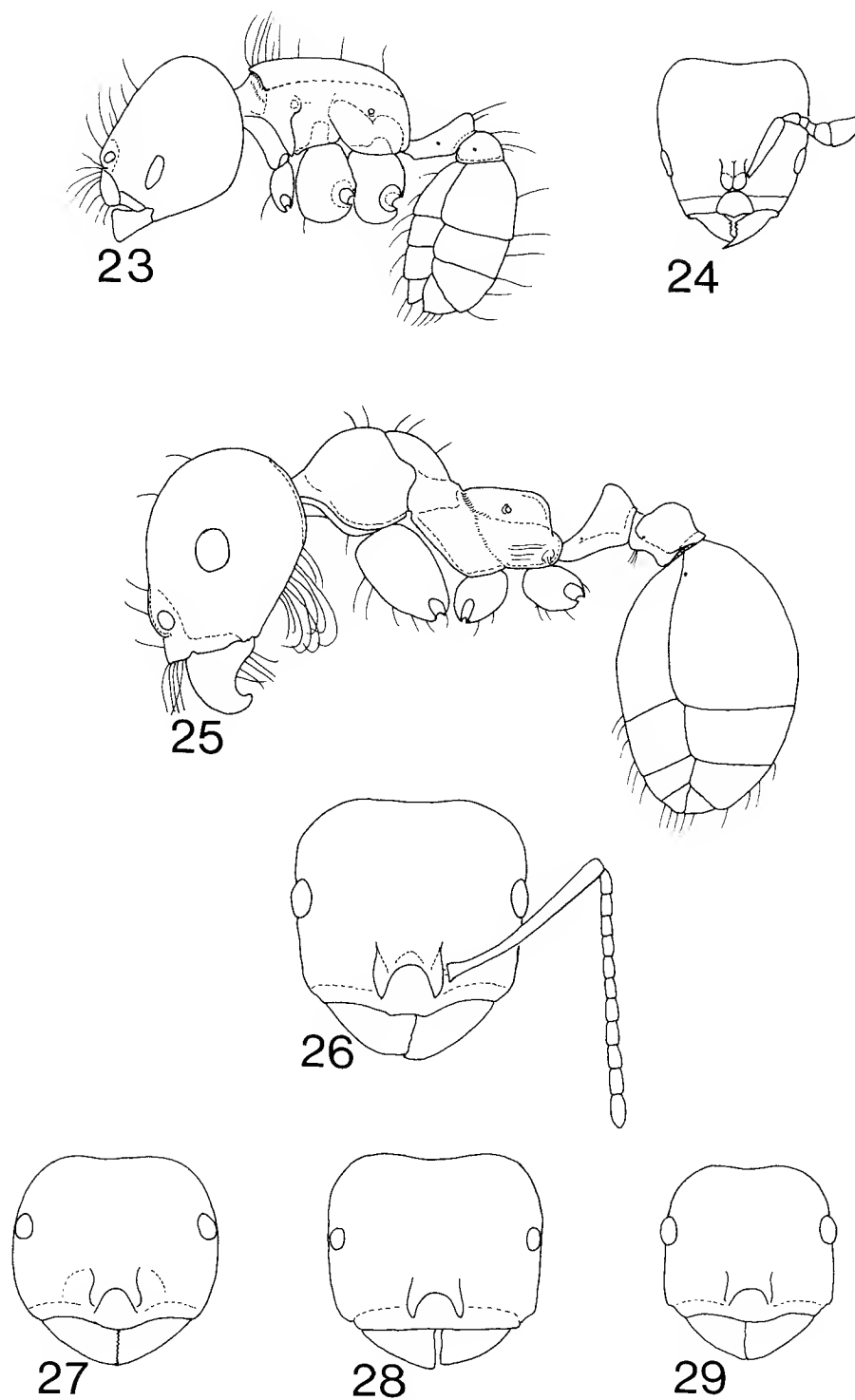
(Figs 23, 24)

*Melissotarsus* Emery, 1877: 378. Type-species: *Melissotarsus beccarii* Emery, 1877: 379, fig., by monotypy.

**DIAGNOSIS OF WORKER.** Myrmicine ants with moderate to conspicuous size variation in most nest samples, living under bark and in wood of live trees; general appearance as in Figs 23, 24. Mandibles short, when unworn armed with a long finger-like apical tooth followed by two much smaller teeth and sometimes also by a minute basal denticle. With wear these gradually become an undifferentiated blunt margin. Palp formula 0,1 (*weissi*). Median portion of clypeus bluntly triangular in shape and somewhat raised, not projecting back between the frontal lobes. Lateral portions of clypeus simple and unmodified. Frontal lobes narrow, confluent centrally and separated only by a narrow impressed line; the anteriormost parts of the frontal lobes abut the posterior clypeal margin. Antennal scrobes absent. Frontal carinae absent. Antennae with six segments, the scapes very short (SI 39–47), the two apical segments forming a strong club. Eyes present, distinctly longer than broad and set in front of the midlength of the sides. Alitrunk short, fusiform and box-like, without dorsal sutures or impressions except in the very largest individuals where rarely a metanotal impression is shallowly present. Propodeum unarmed and rounded. Metapleural lobes absent. Lateral portions of pronotum reduced to a narrow V-shaped wedge below the level of the conspicuous mesothoracic spiracle. Anterior coxae small, much smaller than the massively developed middle and hind coxae. Propodeal spiracle round, situated low on the side of the propodeum and just behind its midlength. Metapleural gland system easily visible through the cuticle. Basitarsal segment of each leg greatly swollen, as wide as the preceding tibia, terminating apically in a circlet of small teeth on the anterior (leading) edge on the middle and hind basitarsi. Petiole with an anterior peduncle and a small low posteriorly situated node which is broadly attached to the postpetiole; the latter broadly attached to the gaster. Dorsal alitrunk finely longitudinally costulate throughout. Elongate fine hairs present dorsally on head and body, and also present on the upper surfaces of the scapes and outer surfaces of the tibiae.

This small genus, of which only four uncommon species are presently recognized, is restricted to the Malagasy region (1 species) where it is rare, and the Afrotropical region (3 species) where it is, however, very widespread. The species nest in the healthy wood of living trees, apparently tunnelling their own galleries below the surface. For this reason most collections of *Melissotarsus* are made more by luck than by intent as their presence in the wood is usually not detectable on the surface. Delage-Darchen (1972) has shown that the method of walking in these ants is very strange; they progress on their front and hind legs with the middle pair projecting upwards, and presumably in contact with the gallery roof. She also noted the presence of coccids inside the galleries, also discussed by Ben-Dov (1978). It seems probable that coccid secretions form a major, if not the main, item in the diet of *Melissotarsus* species.

The genus most closely related to *Melissotarsus* is *Rhopalomastix* Forel, represented by three or four poorly defined species distributed throughout the Oriental and Indo-Australian zoogeographical regions and utilizing the same lifeway as *Melissotarsus*. Since Emery (1922a) and Wheeler (1922) produced their classifications these two small genera have always been placed together in a tribe of their own (*Melissotarsini*) and it is fairly certain that they represent two stages on a single adaptive line. *Rhopalomastix* is the more generalized of the two, *Melissotarsus* decidedly the more specialized, but the modifications seen in the latter are foreshadowed in the former genus. It is the accentuation of these adaptive specializations which separates the genera, as follows.



**Figs 23–29** 23, 24, profile and head of *Melissotarsus weissi*. 25–29, *Messor* workers. 25, profile of *angularis*. 26–29, heads of (26) *angularis*, (27) *striatifrons*, (28) *decipiens*, (29) *denticornis*. Pilosity omitted from 24, 26–29.

*Rhopalomastix*

Antennae 10-segmented.

Lateral portion of pronotum extensive, distinctly larger than the mesopleuron.

First coxa as large as or larger than the second and third coxae.

Petiole sub-sessile, with a strong ventral process.

Free posterior face of petiole node long, its articulation with the postpetiole narrow.

Basitarsal segment of each leg not swollen, without apical circlets of teeth.

Sting long and strong.

*Melissotarsus*

Antennae 6-segmented.

Lateral portion of pronotum very reduced, forming a V-shaped narrow wedge which is smaller than the mesopleuron.

First coxa much smaller than the swollen second and third coxae.

Petiole short-pedunculate, with feeble or no ventral process.

Free posterior face of petiole node very short, its articulation with the postpetiole very broad.

Basitarsal segment of each leg strongly swollen, with apical circlets of teeth.

Sting very reduced and probably non-functional.

So little material of *Melissotarsus* is available at present that this survey must be regarded as strictly preliminary. Three species are now recognized in the Afrotropical region but it is possible that each may be compounded of more than one different sibling-species. Conversely it is by no means impossible that further collections will bridge what appear here as species for the differences between them, though consistent in the few samples to hand, are relatively minor and may well be annulled by further collecting.

For the present I define *weissi* as having a dark brown to black strongly sclerotized male, and a similarly coloured female in which the postpetiole in dorsal view is quite narrow (1.20–1.40 × broader than long) and has a rounded or even hemispherical anterior margin. The worker of *weissi* has the alitrunk medium to dark reddish brown, the anterior margin of the pronotum in dorsal view sharply defined and angular where it meets the anterior declivity, and the sides of the alitrunk meeting the dorsum in a fairly well-defined angle.

*M. emeryi* and *beccarii*, on the other hand, have pale yellow feebly sclerotized males, and have females in which the postpetiole in dorsal view is quite broad (1.90–2.20 × broader than long) and lacking a rounded anterior margin, the margin instead being more or less straight or even slightly concave. The workers are yellow to light yellowish brown and have the sides of the alitrunk rounding bluntly into the dorsum when seen in dorsal view. Females of *emeryi* differ from those of *beccarii* as in the former the mesoscutum is broader than long in dorsal view; it is longer than broad in the latter. Workers of *emeryi* have the anterior margin of the pronotum sharply defined and angular where it meets the anterior declivity, whereas in *beccarii* there is no such sharp differentiation between dorsum and anterior declivity, instead the one surface rounds bluntly into the other.

The shape of the alitrunk in dorsal view shows subtle but perhaps significant differences between separate series of workers presently grouped as single species, but discovering whether these differences are meaningful, or even consistent, will have to await the amassing of considerably more samples than are presently available.

### Synonymic list of Afrotropical *Melissotarsus* species

*beccarii* Emery

*titubans* Delage-Darchen **syn. n.**

*emeryi* Forel

*emeryi* var. *pilipes* Santschi **syn. n.**

*compressus* Weber **syn. n.**

*weissi* Santschi

*major* Santschi **syn. n.**

### Key to species (workers)

- 1 With the alitrunk in dorsal view the anterior margin of the pronotum rounding evenly into the anterior declivity, the two not meeting in a sharp angle or edge. (Ethiopia, Tanzania, South Africa, Ivory Coast) . . . . . *beccarii* (p. 336)

- With the alitrunk in dorsal view the anterior margin of the pronotum separated from the anterior declivity by a sharp angle or edge . . . . . 2
- 2 Sides of alitrunk meeting dorsum in a fairly well-defined angle. Alitrunk colour medium to dark reddish brown. (Ghana, Congo, Zaire) . . . . . *weissi* (p. 337)
- Sides of alitrunk rounding bluntly into the dorsum. Alitrunk colour yellow to light yellowish brown. (Ethiopia, Sudan, Kenya, Tanzania, Zaire, Central African Republic, South Africa, Ivory Coast, Ghana) . . . . . *emeryi* (p. 337)

The three presently recognised species are basically so similar that to present a full description for each would be redundant so, for the purposes of identification, a description of the type-species *beccarii* is given and the other two are compared to it.

### *Melissotarsus beccarii* Emery

*Melissotarsus beccarii* Emery, 1877: 379, fig. Syntype workers, ETHIOPIA: Keren (*Beccari*) (MCSN, Genoa; MHN, Geneva) [examined].

*Melissotarsus titubans* Delage-Darchen, 1972: 216, figs 1–10. Syntype workers, females, males, IVORY COAST: Lamto (*Delage-Darchen*) (probably in collection of Delage-Darchen). **Syn. n.**

**WORKER.** TL 2.3–3.3, HL 0.56–0.82, HW 0.56–0.80, CI 97–105, SL 0.24–0.34, SI 39–47, PW 0.34–0.55, AL 0.58–0.80 (15 measured).

With the head in full-face view the occipital margin concave, sometimes deeply so medially, and with the sides convex and weakly to distinctly convergent in front of the eyes. Mandibles with a long finger-like apical tooth, worn down to nothing in some specimens; the mandibles unsculptured. Eyes much longer than broad, strip-like in many, the maximum diameter 0.12–0.16, about 0.18–0.22 × HW. Median portion of clypeus raised above the level of the lateral portions, not extending back between the frontal lobes; the latter contiguous and separated only by an impressed line. Scapes very short, SI < 50. Alitrunk in dorsal view with anterior pronotal margin rounding into the declivity, the two surfaces not separated by a sharp edge or angle. Dorsum of alitrunk roughly rectangular longitudinally, somewhat narrower behind than in front but not strongly so, and with the dorsum rounding into the sides. In profile the promesonotal dorsum and anterior propodeum are more or less flat but the posterior part of the propodeum rounds very broadly and evenly into the declivity, without trace of armament. Fore coxae small, about half the size of the strongly swollen middle and hind coxae. Peduncle of petiole short and grading into the relatively high narrow node, the node with a short posterior free face, broadly attached to the postpetiole. In dorsal view the petiole node much broader than long. Postpetiole in dorsal view much broader than long, slightly broader than the petiole and very broadly attached to the first gastral tergite without a posterior constriction. Gaster only feebly sclerotized, crumpled in most mounted specimens. Dorsum of head with a silky superficial ground-sculpture upon which scattered small pits are usually superimposed. The ground-sculpture may cover the whole head but frequently it fades out occipitally. Median portion of clypeus more densely and strongly sculptured than dorsum of head capsule. Dorsal alitrunk finely longitudinally costulate throughout, the costulae fading out where the propodeal dorsum rounds into the declivity. Dorsal surfaces of head, scapes, pronotum, mesonotum, pedicel segments and gastral tergites with scattered sparse long fine hairs. Propodeal dorsum usually with one or two shorter hairs but these are frequently missing. Dorsal (outer) surfaces of tibiae with sparse long hairs similar to those on alitrunk. Head and alitrunk dull yellowish brown to dark yellow, the gaster lighter, usually pale dull yellow.

The key character given to separate *beccarii* and *emeryi* workers is quite weak. In most individuals there is a reasonable visible difference between the two, with the anterior pronotal margin rounding bluntly into the declivity in *beccarii*, and with the anterior pronotal margin separated from the declivity by an angle or edge in *emeryi*. Having said that, however, it should be pointed out that the difference is not so well marked in some individuals, which in consequence are difficult to place. Both species have a pale yellow feebly sclerotized male. Females of both species have the postpetiole in dorsal view conspicuously broader than long but it seems that two species are present as in some the mesoscutum is longer than broad (*beccarii*) but in others broader than long (*emeryi*). It should be admitted that very few worker-associated females are known and further collections may annul this apparent difference. To sum up, for the present I recognise these two as separate on the strength of the differently shaped mesoscutum in females and the form of the anterior pronotal margin in workers, but harbour a suspicion that only a single real species may in fact be represented here.

*M. beccarii* differs from *weissi* fairly consistently in all castes. The workers of *weissi* are darker in colour than those of *beccarii* and have both the anterior pronotal margin and the sides of the alitrunk relatively strongly marginate. The male is dark brown to black and strongly sclerotized, and in the female the postpetiole is relatively narrow in dorsal view with an arched-convex anterior margin which is quite different in shape from the strongly transverse form seen in *beccarii*. Measurements of the postpetiolar widths of the various forms are given under the discussion of the genus.

#### MATERIAL EXAMINED

**Ivory Coast:** Lamto Field Station (*W. L. Brown*); nr Abidjan (*W. L. Brown*). **Ethiopia:** Keren (*Beccari*). **Tanzania:** Lulanguu (*G. D. H. Carpenter*). **South Africa:** Natal, Durban (*C. B. Cooper*); Durban (*H. B. Marley*).

#### *Melissotarsus emeryi* Forel

*Melissotarsus emeryi* Forel, 1907: 133. Syntype workers, ETHIOPIA: Colba, 1905 (*M. de Rothschild*) (MHN, Geneva) [examined].

*Melissotarsus emeryi* var. *pilipes* Santschi, 1914a: 71. Syntype workers, KENYA: Taveta, 750 m, st. no. 65, iii.1912; and TANZANIA: Kilimanjaro, Bismarckhügel, 2740 m, st. no. 70, iii.1912 (*C. Alluaud & R. Jeannel*) (NM, Basle) [examined]. **Syn. n.**

*Melissotarsus compressus* Weber, 1952: 1, figs 28, 29. Holotype female, CENTRAL AFRICAN REPUBLIC: Ubangi-Shari, Haut Mbomu, lat. 5° 30' N., long. 25° 15' E., iii.1948, no. 2184 (*N. A. Weber*) (AMNH, New York) [examined]. **Syn. n.**

WORKER. TL 2.5–3.4, HL 0.66–0.88, HW 0.70–0.90, CI 100–105, SL 0.30–0.38, SI 39–43, PW 0.37–0.57, AL 0.62–0.88 (13 measured).

Answering to the description of *beccarii* but with the anterior pronotal margin in dorsal view separated from the anterior declivity by a well defined angle or edge.

As pointed out under *beccarii* a few individuals seem intermediate between those of *emeryi* and those of *beccarii*, and in consequence are difficult to place. My suspicions are that these two names may represent a single species but I feel unsure enough to avoid synonymizing them whilst the apparent difference between the females remains unresolved. So, until the taxonomic value of the shape of the mesoscutum in females can be assessed, the two must remain as separate species.

#### MATERIAL EXAMINED

**Ethiopia:** Colba (*Rothschild*). **Sudan:** Darfur, Jebel Murra (*M. Steele*). **Kenya:** Muguga (*K. Njukiine*); Taveta (*Alluaud & Jeannel*). **Zaire:** Popokabaka (*E. S. Ross & R. E. Leech*). **Ghana:** Tafo (*C. A. Collingwood*). **South Africa:** Cape Prov., Clanwilliam (*Y. Ben-Dov*). **Central African Republic:** Haut Mbomu (*N. A. Weber*).

#### *Melissotarsus weissii* Santschi

(Figs 23, 24)

*Melissotarsus weissii* Santschi, 1910: 356, fig. 3. Holotype female, CONGO: Brazzaville (*A. Weiss*) (NM, Basle). [Only gaster and one forewing remaining on mount.]

*Melissotarsus major* Santschi, 1919: 85. Syntype workers, ZAIRE: Penghe, 13.ii., no. 125 (*Bequaert*) (NM, Basle; MRAC, Tervuren) [examined]. **Syn. n.**

WORKER. TL 2.3–3.0, HL 0.58–0.74, HW 0.60–0.78, CI 98–104, SL 0.27–0.34, SI 41–47, PW 0.36–0.50, AL 0.56–0.84 (14 measured).

Answering to the description of *beccarii* but darker in colour, the alitrunk medium to dark reddish brown; with the anterior pronotal margin meeting the anterior declivity in a well-defined angle or edge, and with the sides of the alitrunk meeting the dorsum in a fairly well-marked angle.

Lighter coloured workers may sometimes be difficult to separate from *emeryi*, but in general the sharper marginations of the sides of the alitrunk in *weissii* are fairly distinct. The sexual forms of *weissii* are both easily separated from those of *emeryi* as the male of the former is dark brown to black (pale yellow and feebly sclerotized in the latter), and the female of *weissii* has the postpetiole relatively narrow in dorsal view with an arched-convex anterior margin, as opposed to a very broad and distinctly transverse postpetiole in *emeryi*.

## MATERIAL EXAMINED

**Ghana:** Tafo (B. Bolton). **Zaire:** Kamaiembi (H. Schouteden); Penghe (Bequaert).

**MESSOR** Forel

(Figs 25–32, 35–43)

*Messor* Forel, 1890a: lxviii [as subgenus of *Aphaenogaster* Mayr]. Type-species: *Formica barbara* L., 1767: 962, by subsequent designation of Bingham, 1903: 277.

*Messor* Forel; Bingham, 1903: 277. [Raised to genus.]

*Cratomyrmex* Emery, 1891: 572. Type-species: *Cratomyrmex regalis* Emery, 1891: 572, by monotypy. [Synonymy by Emery, 1922a: 357.]

*Veromessor* Forel, 1917: 235 [as subgenus of *Novomessor* Emery]. Type-species: *Aphaenogaster andrei* Mayr, 1886: 448, by subsequent designation of Emery, 1921: 67. **Syn. n.**

*Veromessor* Forel; Wheeler, 1922: 680. [Raised to genus.]

*Lobognathus* Enzmann, 1947: 152 [as subgenus of *Veromessor*]. [Erroneous entry for *Veromessor lobognathus* (Andrews); see Brown, 1949: 49.]

**DIAGNOSIS OF WORKER.** Granivorous myrmicine ants, mostly strongly polymorphic but a few monomorphic or only weakly polymorphic. Head massively constructed in larger workers. Mandibles large and powerful, multidentate in smaller workers (up to 15 teeth) but this number usually decreasing with increased body size until in largest workers only a few massive teeth or an edentate crushing edge remains. Sometimes also in small workers the teeth are worn down to an edentate margin. Palp formula predominantly 4,3 but in largest workers usually 5,3 (30 species dissected). Median portion of clypeus broad and shield-like, broadly inserted between the widely separated frontal lobes; both median and lateral portions of clypeus unmodified except for a central impression of the anterior margin in some species. Frontal lobes short but conspicuous, at least partially concealing the antennal insertions. Frontal carinae absent. Antennal scrobes absent. Antennae 12-segmented, either filiform and without an apical club (in which case the flagellar segments gradually increase in size apically), or with a feebly defined incipient club where the apical 3–4 segments are slightly enlarged. Eyes present, moderate to large in size, situated at or just behind the midlength of the sides in full-face view. Ventral surface of head with elongate ammochaete hairs which usually form a psammophore. This may be reduced and non-functional in some species but the hairs are still conspicuous and generally longer than those found elsewhere on the body; in a few species the psammophore is better developed in smaller than in larger workers. With the alitrunk in profile the promesonotum swollen and convex, frequently dome-like and sloping down steeply behind to the metanotal groove which is weakly to distinctly impressed. Propodeum rounded to strongly bispinose posteriorly and on a much lower level than the convex promesonotum. Promesonotal suture fused and inflexible but its track represented by a distinct arched impression across the dorsum. Mesonotum bounded by impressions on all sides, its boundary easily discernible except in the smallest workers of a few species. Metapleural lobes absent or at most represented by a pair of low broadly rounded ridges. Propodeal spiracle large and conspicuous, circular to subcircular and situated approximately at the midlength of the propodeum or sometimes slightly behind the midlength, but never shifted conspicuously back towards the declivity. Basal posterior portion of mesopleuron just above the middle coxa with a few hairs projecting downwards and backwards. (Whether these are guard-hairs indicating the exit site of a gland is not known, but the hairs remain even in species where other body pilosity is very reduced or absent.) Spurs on posterior tibiae varying from very feebly pectinate through partially barbulate and minutely barbulate to simple. Alitrunk ventrally with a strong metasternal process which is usually large to very large (reduced but still conspicuous only in *rufotestaceus* (Foerster) and *vaucheri* Emery out of 45 species dissected). Petiole with a long anterior peduncle, the spiracle situated at about the midlength of the peduncle, well in front of the node. Petiole node in profile narrow and often bluntly triangular to conical in shape, but frequently a sloping differentiated dorsal surface is present where the anterodorsal angle is generally the highest point.

*Messor* is a moderately sized genus of granivorous ants occurring in grassland and savannah, and in arid to desert situations. The main base of the genus is in the Palaearctic region where about 70–80 species occupy a broad strip of territory reaching across the whole width of North Africa and the southern European countries, across the Near and Middle East and thence eastwards through the U.S.S.R. to China and Japan. Compared to this the faunas of other zoogeographical regions are relatively minor. The Afrotropical region has 12 species and Madagascar has 1; the Oriental region has 3–4 species and the Nearctic has 8, all distributed on the western side of the continent and formerly occupying a genus of their own, *Veromessor*, now synonymized. Species



of *Messor* are absent from the Neotropical region, the Indo-Australian region and Australasia, nor do they occur on any of the Pacific island systems.

Recent studies of *Messor* include those of Arnoldi (1977) on the fauna of the U.S.S.R., and Collingwood (1978) on the species of the Iberian Peninsula. The only previous synthesis of sub-Saharan African species is that of Arnold (1920), for the then-recognized South African forms, but no key was given in that revue. Creighton (1950) has keyed the North American species formerly in *Veromessor*. Knowledge of the detailed biology of the species is sparse, but good basic work has been done on some African species by Lévieux & Diomande (1978), and Lévieux (1979).

The closest relatives of *Messor* are the genera *Aphaenogaster* and *Pheidole* Westwood. Members of the latter genus are easily separated from *Messor* as the palp formula is reduced to 2,2, its species are dimorphic, and the antennal funiculus ends in a strongly defined 3-segmented club. *Aphaenogaster*, which is absent from sub-Saharan Africa, is more difficult to differentiate as its species, apart from being uniformly monomorphic, are very close to *Messor* and share most of its diagnostic characters, including the filiform to feebly clavate funiculi and high palp formula (PF) count. Of 55 species of *Aphaenogaster* dissected 31 had PF 5,3, and 24 had PF 4,3. For some reason, although species with the higher PF apparently outnumber those with the lower count, the zoogeographical distribution of the latter is much wider than that of the former. *Aphaenogaster* species with PF 5,3 are found in the Nearctic, Palaearctic and Oriental regions; species with PF 4,3 are also found in these three regions and in the Neotropical, Malagasy, Indo-Australian and Australasian regions as well.

After a study of *Aphaenogaster* for genus-level characters, primarily a search for strong characters to separate it from *Messor*, it became apparent that Brown (1973) was correct in relegating the former subgenera of *Aphaenogaster* to the synonymy. These former subgenera (*Attomyrma* Emery, *Deromyrma* Forel, *Nystalomyrma* Wheeler and *Planimyrmica* Viehmeyer) have no significance as they are founded upon minor, inconsistent or gradient character-states. Further, it is now clear that Brown (1974) was also correct in assigning *Novomessor* to the synonymy of *Aphaenogaster*. The only real character separating the two was the fore-wing venation, there being one closed cubital cell in the former and supposedly two in the latter. The same character was invoked to separate *Veromessor* from *Messor*, again the former having one, the latter two closed cubital cells. A survey of the venation of *Aphaenogaster* and *Messor* shows that in both genera the same finely graded series of changes in wing venation occurs (Figs 35–43), which obviates these supposed differences in number of closed cubital cells; it is instructive to consider both genera together.

The most complete, and therefore most primitive, venation pattern (Fig. 35, *M. galla*) shows two closed cubital cells and has  $R_s + M$  dividing well in front of the level of cross-vein  $m - cu$ , so that  $m - cu$  arises from  $M$  itself and there is a short free section of  $M$  between the point of division of  $R_s + M$  into its constituent parts and the point where  $m - cu$  meets  $M$ .

The free section of  $M$  then contracts (Fig. 36; *M. tropicorum*, *angularis*, *nigriceps* Santschi; *A. geei* Wheeler, *schurri* (Forel)) as the fusion of  $R_s + M$  lengthens outwards along the wing until the condition shown in Fig. 37 is seen (*M. rugosus* (André); *A. schurri*) where there is no free portion of  $M$  between  $R_s + M$  and the point of origin of  $m - cu$ , the veins  $R_s$ ,  $M$  and  $m - cu$  all appearing to arise from a point at the apex of  $R_s + M$ .

Next, the fusion of  $R_s + M$  advances further out along the wing so that  $R_s$  and  $M$  now separate a short distance beyond the point of origin of  $m - cu$ , which now arises direct from  $R_s + M$  (Fig. 38; *M. intermedius* Forel, *angularis*, *himalayanus* Forel, *aciculatus* (Smith), *structor* (Latreille), *regalis*; *A. rudis* Emery, *treatae* Forel). Following this the fusion of  $R_s + M$  advances further out along the wing, drawing closer to cross-veins  $2r$  and  $r - m$ , as shown in Figs 39, 40, this stage constituting what may be considered as the normal pheidoline venation (*M. barbarus* (L.), *capitatus* (Latreille), *structor*, *galla*, *denticornis*, *capensis*, *leubberti*, *muticus* (Nylander), *aegyptiacus* (Emery), *nigriceps* Santschi, *semirufus* (André), *instabilis* (Smith), *meridionalis* (André); *A. geei*, *rudis*, *lamellidens* Mayr, *famelica* (Smith), *fulva* Roger, *japonica* Forel, *pallida* (Nylander), *huachucana* Creighton, *splendida* (Roger), *megommatus* Smith, *subterranea* (Latreille), *occidentalis* Emery, *crocea* André, *gemella* (Roger), *senilis* Mayr).

As the fusion of  $R_s + M$  progresses still further along the wing a critical point is reached at which cross-vein  $r - m$  vanishes. This occurs whilst the advancing fusion is still some little distance away from  $2r$ . A male of *A. spinosa* Emery in BMNH shows the critical point as the specimen has  $r - m$  present on the left wing but it has vanished from the right. The disappearance of  $r - m$  leaves the venation as in Fig. 41, which is present in a wide range of species (*M. pergandei* (Mayr), *lobognathus*, formerly of *Veromessor*; *A. albisetosus* Mayr, formerly of *Novomessor*; *A. dromedarius* (Emery), *longiceps* (Smith), *pythia* Forel, *phalangium* Emery, *beccarii* Emery, *araneoides* Emery, *sagei* Forel).

Eventually the stage seen in Fig. 42 is reached where  $R_s$  and  $M$  are fused to the point of intersection of  $2r$  (*M. andrei* (Mayr); *A. cockerelli* André), and finally in *A. ensifera* Forel the fusion of  $R_s + M$  has extended beyond the level of  $2r$  so that this cross-vein now arises from  $R_s + M$  (Fig. 43).

It should be pointed out that there is considerable variation present along this sequence within single species and that it is by no means rare to find specimens with different venation patterns on the left and right forewings, representing different stages in the sequence, and thus showing it to be a dynamic rather than a static system. Also, adventitious vein-stubs frequently arise at random from all the main veins, and from the cross-veins too on occasion.

Thus the loss of  $r - m$  cross-vein, reducing the two cubital cells to only one, rather than being the concise taxonomic character it was thought to be in the past, can now be seen as just one step in a long gradual sequence of venation development in both *Aphaenogaster* and *Messor*, and of no significance in genus-level discrimination among these ants. To draw a line at any point in the sequence and claim that it is more significant than a line drawn at any other point is thus purely arbitrary, and as a direct consequence of the establishment of this sequence the synonymy of *Novomessor* with *Aphaenogaster* is confirmed and the name *Veromessor* falls into the synonymy of *Messor*, there being no other consistent character to separate them.

A side development in the history of *Novomessor*, following Brown's (1974) synonymy, was the suggestion of Hölldobler, Stanton & Engel (1976) that the name might be resurrected for two of its former members (*albisetosus* and *cockerelli*) because of the presence of an exocrine gastral glandular system which was absent from other *Aphaenogaster* species examined, and incidentally absent also from the third former *Novomessor* species (*ensifera*), which was to be retained in *Aphaenogaster* despite the fact that it is otherwise very close to the first two. The obvious inference was that the presence of such a gland system merited genus-level consideration. This is reasonable logic as far as it goes, though many would argue (myself included) that basing genera on such features is grossly over-weighting a relatively weak single character. The discussion would probably have rested there but Kugler (1978) published a paper indicating that such glands occur widely in the Myrmicinae in a range of genera, including a member of *Aphaenogaster* (*phalangium*) whose placement in that genus has never been doubted, but which is not closely related to any of the three mentioned above. This gives rise to three possibilities.

Firstly, that the presence of such glands is highly significant and that, following the model of *Aphaenogaster*-*Novomessor*, every species showing such structures must be assigned to a genus separate from the parent genus, irrespective of any basic similarities they may otherwise show. The idea is ludicrous of course, and obviously not at all what Hölldobler *et al.* intended; the plethora of pointless generic names thus produced would be incredible and no more sensible than selecting genera from groups of closely related species on grounds of, say, presence or absence of hairs on the first gastral tergite. Hölldobler *et al.* in their study found a gastral exocrine system in one species of *Ocymyrmex* Emery but not in two others; they did not suggest the creation of a separate genus here.

Secondly, we can reassign such forms with gastral exocrine glands (or indeed any other individual specialization) when it suits us to do so, and ignore it otherwise. Thus we can utilize such a character to prop up an otherwise poorly defined or undefinable genus which looks like falling irrevocably into the synonymy. This idea does not hold much merit as it again leads unerringly to the creation of swarms of peripheral genera, each with only one or two species, which cannot be adequately separated from their closest relatives remaining embedded in the central mass of species.

Finally, we can consider that the development of such gland systems in some species of a genus but not in others, whilst uniformly stable genus-level characters span the entire range of species, reflects a specialization in the lifeway of the ants involved and is significant at species or species-group level but not beyond that, providing always that other genus-level characters remain uniform throughout. This is decidedly the alternative which I favour as in the long run it will produce strong, well-defined genera, and realistic species-groups within those genera.

To conclude the observations on the genus-level synonymy of *Aphaenogaster*, it is now apparent that the monotypic genus *Brunella* Forel sinks as a synonym. This Malagasy species has had a chequered career since its original description as *Aphaenogaster* [sic] *belti* Forel, 1895: 248. (Syntype workers, MADAGASCAR: Imerina, Moramanga (*M. Sikora*) (MHN, Geneva) [examined].) It was later shifted by Forel (1917) out of *Aphaenogaster* to form the type-species of his genus *Brunella*. Emery (1922a: 242) disagreed with this and synonymized *Brunella* under *Atopula* Emery, which for him was a catch-all genus to which a number of obscure species were relegated. During my study of the tetramorine genera (Bolton, 1976) it transpired that the type-species of *Atopula* was in fact a *Tetramorium*, so that the name *Atopula* fell into synonymy and the remaining former occupants of *Atopula* were transferred to other genera. At that time I had not examined the type-series of *belti* and so referred the species back to Forel's temporarily resurrected *Brunella*. Now, having at last examined the types of *belti*, it turns out to be a fairly unexceptional *Aphaenogaster* which seems to belong to the Oriental *sagei*-group as it has a broad occipital margin, relatively short antennal scapes, a moderately well-developed antennal club and distinct propodeal spines.

A summary of the current genus-level synonymy of *Aphaenogaster* is given in the appendix, p. 364.

Of the two names synonymized with *Messor* above, *Cratomyrmex* was recognized as a synonym by Emery as long ago as 1922. The separation of the two was based on the presence of pectinate hind tibial spurs in the latter and their supposed absence in the former. This was quickly spotted as a feeble and variable character and the status of the genus challenged (Santschi, 1920). The form of the hind tibial spurs is in fact very variable in *Messor*, showing all stages from feebly pectinate, through barbate and minutely barbate to simple. Even in the same series there is sometimes variation in spur form between different-sized workers.

*Veromessor*, which began its existence as a subgenus of *Novomessor*, was given generic status by Wheeler (1922) who separated it from *Messor* on the venation character discussed above and now known to be spurious. The discussion in Wheeler & Creighton (1934: 356–360) indicated that *Messor* and *Veromessor* were extremely closely related, but no means of separating them was given. Presumably only the venation character invoked previously by Wheeler could be found. The present investigation has shown the two to be synonymous for, leaving aside the venation, all characters of *Messor* are duplicated in *Veromessor*, except for the species *relictus* Wheeler & Mann. This last was originally described as a member of *Aphaenogaster* but was transferred to *Veromessor* by Wheeler & Creighton (1934), for no apparent reason. In my opinion it is an ordinary member of *Aphaenogaster*, fitting the diagnostic characters of that genus and having all the criteria required to separate it from *Messor* which are tabulated below; it is herewith returned to *Aphaenogaster*. Finally, the fossil species *sculpturatus* Carpenter, originally described in *Messor* (where it is a junior secondary homonym of *sculpturatus* Stitz), later included in *Veromessor* but suggested as a possible *Pogonomyrmex* species by Wheeler & Creighton, is impossible to place at present and requires further study. The living North American species now included in *Messor* are *andrei* (Mayr) **comb. n.**, *chamberlini* Wheeler, *julianus* (Pergande) **comb. n.**, *lariversi* (Smith) **comb. n.**, *lobognathus* Andrews, *pergandei* (Mayr) **comb. n.**, *smithi* (Cole) **comb. n.**, *stoddardi* (Emery) **comb. n.**

*Aphaenogaster* and *Messor* are very closely related and certainly derive from a single parent stock. The characters tabulated below will separate them even though a few species show exceptions to one or another of the characters.

*Messor*

Mostly polymorphic species (a very few feebly polymorphic and monomorphic species known).  
Mostly with ammochaete hairs present (reduced in a few species).

Head massive and broad, in medium to large workers CI > 90 (range 95–125 in 64 species measured).

Metasternal process large to very large, always very conspicuous (45 species dissected).

Outer margins of mandibles strongly curved towards midline, the mandibles massive and heavy.

*Aphaenogaster*

Entirely monomorphic.

Mostly without ammochaete hairs (present in a very few species).

Head usually slender, CI 90 at maximum, generally much less (range 49–90 in 75 species measured).

Metasternal process small to absent, approaching size seen in *Messor* only in *A. subterranea* (55 species dissected).

Outer margins of mandibles not strongly curved towards midline, the mandibles triangular in shape and not massive.

**Synonymic list of Afrotropical *Messor* species**

*angularis* Santschi stat. n.

*capensis* (Mayr)

*pseudoaegyptiaca* Emery syn. n.

*barbarus* subsp. *capensis* var. *schlencki* Forel (unavailable)

*braunsi* Forel syn. n.

*donisthorpei* Santschi syn. n.

*cephalotes* (Emery)

*plinii* Santschi syn. n.

*collingwoodi* sp. n.

*decipiens* Santschi stat. n.

*barbarum* r. *capense* var. *decipiens* Forel (unavailable)

*barbarus* subsp. *capensis* var. *proba* Forel (unavailable)

*arcistriatus* Santschi syn. n.

*denticornis* Forel

*denticornis* var. *parvidens* Forel syn. n.

*denticornis* var. *brunni* Forel syn. n.

*galla* (Mayr)

*barbarum* subsp. *caduca* var. *galla* Emery (unavailable)

*barbarus* subsp. *semirufus* var. *rufa* Forel (unavailable)

*barbarus* st. *galla* var. *triempessa* Santschi (unavailable)

*barbarus* st. *latinodis* Santschi syn. n.

*barbarus* r. *semirufus* var. *rufula* Forel (unavailable)

*barbarus* subsp. *galla* var. *armata* Emery (unavailable)

*galla* st. *nobilis* Santschi syn. n.

*galla* var. *airensis* Bernard syn. n.

*incisus* Stitz (nomen dubium)

*luebberti* Forel stat. n.

*piceus* Stitz

*regalis* (Emery)

*regalis* var. *rubea* Santschi syn. n.

*sculpturatus* Stitz syn. n.

*ruginodis* Stitz stat. n. (nomen dubium)

*striatifrons* Stitz stat. n.

*tropicorum* Wheeler stat. n.

*denticornis* var. *laevifrons* Stitz syn. n.

*braunsi* var. *nigriventris* Stitz syn. n.

**Key to species (medium to large workers)**

Note. The nomina dubia *incisus* Stitz and *ruginodis* Stitz are omitted from the key.

- |   |  |   |
|---|--|---|
| 1 | Hairs absent from first gastral tergite or at most with a single sparse transverse row at the extreme apex of the sclerite . . . . . | 2 |
| – | Hairs present on first gastral tergite, more or less evenly distributed over the whole surface of the sclerite . . . . .             | 5 |

- 2 Dorsum of propodeum with one or more pairs of standing hairs . . . . . 3
- Dorsum of propodeum without standing hairs . . . . . 4
- 3 Dorsum of head coarsely and densely reticulate-punctate everywhere, the mid-dorsal strip also rugulose. (Niger, Mali) . . . . . *collingwoodi* (p. 346)
- Dorsum of head smooth everywhere except for the rugulose mid-dorsal strip; without coarse dense reticulate-punctate sculpture. (Throughout Sahelian zone and northern East Africa, also occurring coastally in West Africa). . . . . *galla* (p. 349)
- 4 Head sculptured everywhere with close-packed longitudinal rugulae between which is reticulate-punctate ground-sculpture. Eyes slightly smaller,  $0.15-0.18 \times HW$  in HW range of 2.00–3.12. (Tanzania, Zimbabwe, Angola, Botswana, South West Africa, South Africa) . . . . . *leubberti* (p. 351)
- Head smooth except usually for a short central rugular area behind the frontal lobes. Eyes slightly larger,  $0.18-0.21 \times HW$ , in HW range of 2.00–2.76. (Kenya) . . . . . *angularis* (p. 344)
- 5 Basal third or more of first gastral tergite strongly and conspicuously sculptured with rugulae, costulae, coarse reticulate-punctuation, or a combination of these. . . . . 6
- Basal third of first gastral tergite unsculptured except for hair pits and very faint superficial patterning. In some very large workers a few short basigastral costulae may develop but these are restricted to the area immediately behind the postpetiole . . . . . 7
- 6 With the head in full-face view the sides with projecting hairs. Petiole and postpetiole coarsely closely and deeply rugose. (Nigeria, Benin Republic, Congo) . . . . . *regalis* (p. 352)
- With the head in full-face view the sides without projecting hairs. Petiole and postpetiole finely sculptured with feeble rugulae, dense punctuation or a combination of both. (Ethiopia, Kenya, Tanzania) . . . . . *cephalotes* (p. 346)
- 7 Posterior half of clypeus between frontal lobes with a distinct, strongly raised central step or welt. (Angola, South West Africa) . . . . . *tropicorum* (p. 354)
- Posterior half of clypeus between frontal lobes without a raised central step or welt, usually more or less flat or even slightly concave . . . . . 8
- 8 Eyes relatively large, the maximum eye diameter  $0.21-0.25 \times HW$ , in HW range of  $2.50- > 4.00$ . (Botswana, South West Africa, South Africa) . . . . . *denticornis* (p. 349)
- Eyes smaller, the maximum eye diameter  $0.14-0.19 \times HW$ , in HW range of  $2.50- > 4.00$  . . . . . 9
- 9 In HW range  $2.80- > 4.00$  the sides of the head conspicuously evenly convex in full-face view (Fig. 27). Propodeum in profile relatively long and low (Fig. 32). (South West Africa, South Africa) . . . . . *striatifrons* (p. 353)
- In HW range  $2.80- > 4.00$  the sides of the head approximately straight in full-face view, the sides parallel or divergent anteriorly (Fig. 28). Propodeum in profile relatively short and high (Fig. 31) . . . . . 10
- 10 Body pilosity very dark in colour, deep red-brown to blackish. (Botswana, South Africa) . . . . . *piceus* (p. 352)
- Body pilosity pale, white or silvery to yellowish . . . . . 11
- 11 Head red in major workers, contrasting in colour with the much darker alitrunk and gaster. (Zimbabwe, Botswana, Lesotho, South Africa) . . . . . *decipiens* (p. 348)
- Head brown to black in major worker, about the same colour as the alitrunk and gaster. (South West Africa, Botswana, South Africa) . . . . . *capensis* (p. 345)

Among strongly polymorphic species such as these, where there is an enormous worker size-range, the standard measurements which I have otherwise used consistently for the Myrmicinae become meaningless and cannot be utilized. A few standard ratios have, however, proved to be of value in some cases and these are included in the relevant descriptions. The keys and descriptions are based on medium to large workers as these show the best discriminating characters, the minor workers of closely related species being sometimes indistinguishable. Size ranges covered by the descriptions are given for each species in terms of HW range.

The presence or absence of propodeal teeth or spines, which appears to be a functional diagnostic character in other parts of the range of *Messor*, is not of much use in the Ethiopian region species for, although some always have the propodeum armed (*regularis*, *collingwoodi*) and some always have it unarmed and rounded (*angularis*, *leubberti*), the rest show a disconcerting variability in this character, sometimes differing even in individuals from the same nest sample.

The 12 recognizable species are distributed roughly as follows in the Afrotropical region.

Northern (Sahelian) species: *collingwoodi*, *galla*, *cephalotes* (in extreme east).

Western species: *regalis*, *galla* (coastally).

Eastern species: *cephalotes*, *angularis*, *leubberti* (in south), *galla* (in north).

Southern species: *denticornis*, *leubberti*, *striatifrons*, *tropicorum*, *piceus*, *decipiens*, *capensis*.

The species fall into two groups in terms of pilosity. The first group, characterized generally by reduced pilosity and virtual absence of hairs on the first gastral tergite, contains the species *angularis*, *collingwoodi*, *galla*, and *leubberti*. In the second group pilosity is generally dense and is evenly distributed over the first gastral tergite. Included here are the remaining eight species noted above. Of them *regalis* is very conspicuous and not obviously close to any of the others. Of the remainder the southern complex of *piceus*, *decipiens* and *capensis* may represent a single species, and *denticornis*, *striatifrons* and *tropicorum* are closely related.

### *Messor angularis* Santschi stat. n.

(Figs 25, 26)

*Messor barbarus* st. *semirufus* var. *angularis* Santschi, 1914a: 75 [unavailable name]; Santschi, 1928: 202 [*galla* var. *angularis*, first available use of name]. Syntype workers, KENYA: Naivasha, 1900 m, st. no. 14, xii.1911 (C. Alluaud & R. Jeannel) (NM, Basle) [examined].

MEDIUM TO LARGE WORKER. HW 2.00– > 2.75.

Anterior clypeal margin flattened to weakly and quite broadly indented medially. With the head in full-face view the occipital margin indented medially, the indentation becoming more distinct with increased size. In HW range 2.00–2.80 the maximum diameter of the eye is 0.42–0.52, about 0.18–0.21 × HW, and the CI range is 104–113. Propodeum unarmed, rounded to right-angled where dorsum meets declivity and sometimes with a reinforcing ridge or flange following the curve, especially in largest workers. Dorsum of head with sculpture very reduced, sometimes without sculpture. Usually with a few very feeble low longitudinal rugulae between the frontal lobes which may extend for a short distance behind them. On each side of this median area, moving outwards towards the eyes and occipital corners, the head is unsculptured except for a very feeble superficial reticular pattern and a few scattered faint punctulae. Pronotum and mesonotum dorsally unsculptured to feebly densely punctulate, generally with some weak transverse rugulae immediately behind the cervical shield. Rarely these are absent but in some they extend further back on the pronotum than is usual. Propodeal dorsum transversely rugose, conspicuously more strongly sculptured than the pronotum or mesonotum. First gastral tergite unsculptured and smooth, usually with a faint superficial reticular pattern visible. Head dorsally with very reduced pilosity; apart from the strong mouthpart hairs and those around the frontal lobes the dorsum with only 2–3 pairs, spanning the midline of the head. With the head in full-face view the sides both in front of and behind the eyes, the occipital corners and the occipital margin without projecting hairs except mid-occipitally where the posteriormost dorsal pair may project on each side of the occipital impression. Psammophore strong, the J-shaped hairs very long and conspicuous. Pronotum dorsally with 0–3 pairs of hairs, when present situated posteriorly, close to the promesonotal junction. Mesonotum with 0–5 pairs of hairs. Some of this variation may be due to abrasion, the mesonotal hairs in particular seem easily lost. Propodeum always hairless dorsally. Petiole with 0–1, postpetiole with 0–2 pairs of hairs respectively. First gastral tergite hairless or at most with a sparse transverse row at the extreme apex of the sclerite. Colour variable, usually with reddish head and alitrunk and black gaster, but the alitrunk often with some black, the amount of which varies from sample to sample. In extreme cases the entire body black but even here the head with a reddish tint showing through.

One of the four sub-Saharan African species which lacks hairs on most or all of the first gastral tergite, *angularis* is at present known only from Kenya. The most closely related species is the extremely widespread *galla* which also occurs in Kenya. The two are separated as follows.

| <i>angularis</i>  | <i>galla</i>  |
|---|---|
| Propodeal dorsum without hairs.   | Propodeal dorsum with one or more pairs of hairs.   |
| Occipital margin on each side of the median impression without projecting hairs                             | Occipital margin on each side of the median impression with one or more pairs of projecting hairs.  |
| Ventral surface of hind femora without freely projecting hairs or at most with 1–2 close to the trochanter. | Ventral surface of hind femora with numerous freely projecting hairs which usually occur over the length of the shaft but which are often densest proximally. |

Ventral surface of postpetiole in profile without an anterior prominence or at most with a feeble angle, the surface immediately behind this smoothly concave.

Median strip of head dorsally unsculptured or at most with very feeble rugulae anteriorly.

Ventral surface of postpetiole in profile with a sharp dentiform or angular prominence anteriorly, the surface immediately behind this irregular, not smoothly concave.

Median strip of head dorsally usually conspicuously rugulose, only very rarely reduced.

#### MATERIAL EXAMINED

**Kenya:** Tana Riv. (*J. L. Clark*); Olikoriti (*M. G. Lepage*); Kajiado (*J. Darlington*); Bissel (*J. Darlington*); Kajiado (*G. Nyamasyo*); Kajiado (*W. Sands*); Isiolo (*E. S. Ross & R. E. Leech*); Naivasha (*Alluaud & Jeannel*).

### *Messor capensis* (Mayr)

(Fig. 31)

*Atta capensis* Mayr, 1862: 743. LECTOTYPE worker, SOUTH AFRICA: Cape of Good Hope, Novara Expd. "D". (NM, Vienna), here designated [examined].

*Aphaenogaster pseudoaegyptiaca* Emery, 1884: 384. Syntype workers, SOUTH AFRICA: Cape of Good Hope (MCSN, Genoa) [examined]. **Syn. n.**

*Messor barbarus* subsp. *capensis* var. *schencki* Forel, 1910a: 15. Holotype worker, SOUTH WEST AFRICA: Bethanien (*Schenck*) (not found in MHN, Geneva, presumed lost). [Unavailable name.]

*Messor braunsi* Forel, 1913b: 138. Syntype workers, SOUTH AFRICA: Cape Prov., Willowmore (*H. Brauns*) (MHN, Geneva) [examined]. **Syn. n.**

*Messor donisthorpei* Santschi, 1937: 51. Syntype workers, females, SOUTH WEST AFRICA: West of Maltahohe, 1500 m, 12.xii.1934 (*K. Jordan*) (BMNH; MCZ, Cambridge; USNM, Washington) [examined]. **Syn. n.**

#### MEDIUM TO LARGE WORKER, HW 2.35– > 3.40.

Anterior clypeal margin varying from shallowly convex to transverse, only very rarely with the faintest vestige of a median indentation. With the head in fullface view the sides more or less straight and approximately parallel, never evenly convex nor obviously diverging anteriorly. Occipital margin broadly and shallowly concave to indented medially. In HW range 2.35–3.44 the maximum diameter of the eye is 0.40–0.58, about 0.15–0.19 × HW, and the CI range is 103–119. Propodeum in profile with the dorsum rounding narrowly into the declivity in most cases; in some more broadly rounded and in a few right-angled, but only rarely with dentiform prominences and here usually only in the largest workers. Usual sculpture of entire dorsum of head of fine, densely packed parallel longitudinal rugulae, most commonly with fine punctulation between them. Variation in the sculpture consists of a reduction, in density or intensity, or one or both of these components. Sometimes the rugulae are more widely spaced and fainter than is usual, in which case the punctulate ground-sculpture is much more obvious and may appear as the dominant component in places. On the other hand the punctulate sculpture may fade out, leaving the rugulae sharply defined; the rugulae may then also become less intense and leave the head only feebly sculptured. Dorsal alitrunk usually rugose or rugulose everywhere but, as on the head, this sculpture may be reduced until it is very faint or even absent. When distinctly present the direction of sculpture on the pronotum shows variation. Commonly it is longitudinal but forms with the sculpture diagonal, transverse, irregular or varying on different parts of the surface are fairly frequent. First gastral tergite unsculptured or at most with a very faint superficial patterning. All dorsal surfaces of head and body with numerous conspicuous standing hairs. Colour black to dark reddish brown, the head and alitrunk always the same colour, the gaster sometimes darker.

The taxa *capensis*, *decipiens* and *piceus*, treated here as separate species, may in fact represent only a single variable species. The differences invoked to distinguish the three are minor (see key) and may eventually prove to be gradient.

Among the species in which the first gastral tergite is uniformly hairy the three taxa mentioned above are characterized together by their relatively small eyes, lack of strong gastral sculpture, relatively straight-sided head and short propodeum, and lack of a median prominence on the posterior half of the clypeus.

## MATERIAL EXAMINED

**Botswana:** Kuke Pan (*Vernay-Lang*); Gomodimo Pan (*Vernay-Lang*); Gomodimo (*G. U. Son*). **South Africa:** Cape Prov., Willowmore (*G. Arnold*); Willowmore (*H. Brauns*); Grahamstown (*W. L. Brown*); Grahamstown (*F. Jacot-Guillarmod*); Cape Town (*E. Simon*); Cape Town (*J. C. Bridwell*); Cape Town (*R. E. Turner*); Addo (*M. Samways*); Balfour (*E. S. Ross & R. E. Leech*); Fish River Valley (*G. Arnold*); Fort Beaufort (*J. W. G.*); Oudtshoorn (*B. Brunhuber*); Port Elizabeth (*B. Brunhuber*). **South West Africa:** W. of Malahohe (*K. Jordan*).

*Messor cephalotes* (Emery)

*Stenamma* (*Messor*) *barbarum* subsp. *cephalotes* Emery, 1895a: 179. Syntype workers, ETHIOPIA: Arussi Galla, Ganale Gudda, 3.v.1893 (*V. Bottego*) (MCSN, Genoa; MHN, Geneva) [examined].

*Messor cephalotes* (Emery) Emery, 1908: 443. [Raised to species.]

*Messor plinii* Santschi, 1912: 165. Syntype workers, KENYA: Nakuru, 1904 (*C. Alluaud*) (NM, Basle) [examined]. **Syn. n.**

MEDIUM TO LARGE WORKER, HW 3.20– > 5.00.

Median portion of clypeus with anterior margin broadly but shallowly indented-concave. With the head in full-face view the occipital margin more or less transverse, very shallowly impressed medially to virtually straight, only very rarely evenly shallowly convex. Head broad and massive, very strongly transversely convex between the eyes, CI 109–123 in HW range 3.28–5.52. Eyes fairly small, their maximum diameter 0.54–0.72, about 0.13–0.17 × HW within the above-stated HW range; the relatively smaller eyes occurring in larger individuals. Psammophore generally more strongly developed in smaller than in larger workers, the characteristic hooked or J-shaped hairs sparse or absent in very large workers. Propodeal dorsum varying from rounding bluntly and evenly into the declivity to meeting the declivity in a sharp right-angle. In either case a low reinforcing lip or flange may be present which follows the curve, but prominent blunt teeth or lamellae are only very rarely known to develop. Dorsum of head blanketed everywhere with extremely fine, very densely and tightly packed, parallel longitudinal costulae; the head with a silky appearance under low magnification. The direction of the costulae is variable but usually they run straight back from clypeus to occiput centrally on the dorsum, and tend to diverge towards the occipital corners away from this central strip. In very large workers there is a tendency for the direction of the sculpture to be less regular, and even loops or whorls may occur. Dorsal alitrunk densely rugulose everywhere, the sculpture usually transverse but sometimes irregular on the propodeum. Sculpture on propodeal dorsum generally coarser and more widely spaced than on pronotum, and always coarser on pronotum than on dorsum of head. Petiole and postpetiole finely and densely sculptured with feeble rugulae, dense puncturation, or a combination of both. Base of first gastral tergite extensively sculptured with exceedingly fine close-packed scratch-like costulae, or sometimes with dense granular puncturation, or with a combination of both. The extent of this sculpture is variable but always at least the basal third of the first tergite is covered. Pilosity quite dense, all dorsal surfaces of head and body with standing hairs. With the head in full-face view the sides in front of and behind the eyes, and the curved side portions of the occipital corners, without projecting hairs; the occipital margin itself usually with conspicuous projecting hairs. Colour red to reddish dark brown, often with the gaster somewhat darker than the head and alitrunk.

A very distinctive East African species, *cephalotes* is one of the only two known African forms in which the gaster is strongly sculptured. The other, *regalis*, has much coarser sculpture, as noted in the key, and also differs by having the propodeum always bidentate or bispinose, a feature only very rarely developed in *cephalotes*. Beside this the anterior clypeal margin, always concave in *cephalotes*, is shallowly convex and irregular in *regalis*, and the sides of the head, hairless in *cephalotes*, have distinct standing hairs in *regalis*, at least behind the eyes.

## MATERIAL EXAMINED

**Ethiopia:** Ganale Gudda (*V. Bottego*). **Kenya:** Nakuru, (*E. Pinhey*); Nakuru (*T. J. Anderson*); Nakuru (*C. Alluaud*); Lake Ngunga (*Allen & Brooks*); Kericho (*F. W. Dry*); Athi Riv. (*C. S. Betton*); Olikoriti (*M. G. Lepage*); Kajiado (*J. Darlington*); Kajiado (*G. Nyamasyo*). **Tanzania:** Dodoma (*W. M. Mann*); Umbulu (*W. M. Mann*); Arusha (*C. F. D.*).

*Messor collingwoodi* sp. n.

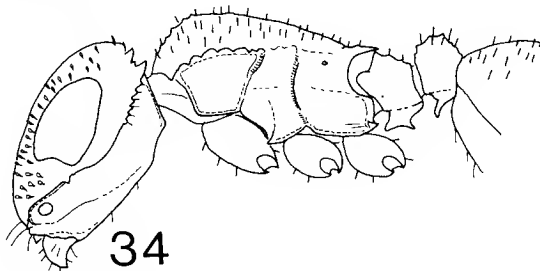
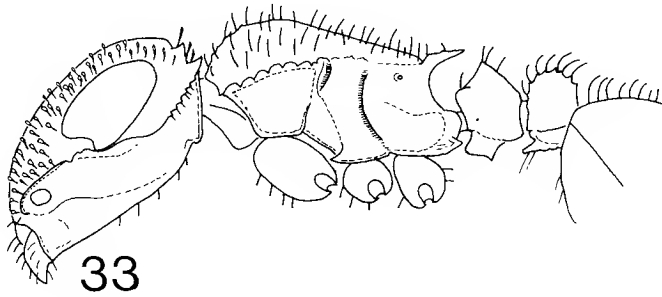
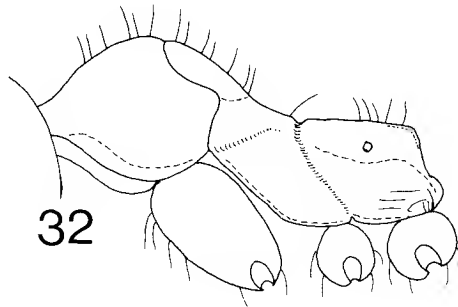
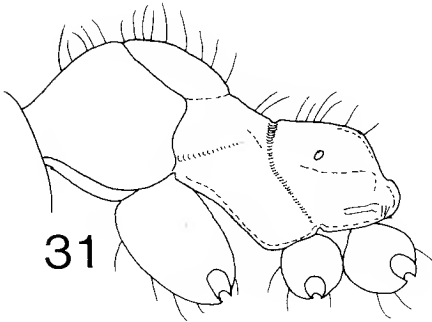
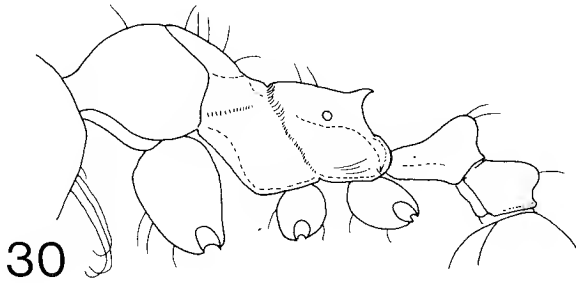
(Fig. 30)

HOLOTYPE WORKER, HW 2.56.

Anterior clypeal margin broadly but shallowly indented medially. With the head in full-face view the sides more or less straight, slightly convergent anteriorly and rounding broadly and evenly into the occipital



margin behind. Occipital margin sharply indented medially. Maximum diameter of eye 0.52, about  $0.20 \times \text{HW}$ , and the CI 107. Propodeum armed with a pair of short but well-developed triangular spines which are somewhat downcurved along their length. Dorsum of head sculptured everywhere. Mid-dorsal strip of head longitudinally rugulose to level of posterior margins of eyes; behind this the rugulae rapidly weakening. Everywhere dorsum of head finely and very densely reticulate-punctate, with superimposed very feeble rugulae away from the more strongly sculptured median strip. Pronotum and mesonotum dorsally



**Figs 30–34** 30–32, *Messor* workers. Alitrunk of (30) *collingwoodi*, (31) *capensis*, (32) *striatifrons*. 33, 34, *Cataulacus* workers. Profile of (33) *centrurus*, (34) *moloch*.

transversely rugulose, the propodeum more strongly transversely rugose. Sides of pronotum less strongly rugulose than the pleurae. First gastral tergite unsculptured except for the usual fine superficial reticular patterning. Dorsum of head sparsely hairy. Discounting the strong pilosity on the mouthparts and around the frontal lobes the dorsum with only a few pairs of hairs spanning the mid-dorsal strip. With the head in full-face view the sides both in front of and behind the eyes lacking projecting hairs. Projecting hairs also absent from occipital corners but a single hair projecting from the occipital margin on each side of the median indentation. Psammophore strongly developed, the J-shaped hairs conspicuous. Dorsal alitrunk without hairs on pronotum, with 4 pairs on mesonotum and one pair on the propodeum. Petiole with one pair, postpetiole and first gastral tergite hairless. Colour uniform very dark blackish brown.

MEDIUM TO LARGE PARATYPE WORKERS, HW 2.16–2.72. As holotype but in some individuals the mid-dorsal rugulae of the head more sharply defined. Variation in pilosity throughout the type-series shows the dorsal head with 2–5 pairs, pronotum with 0–1 pair, occipital margin with 0–2 pairs, mesonotum with 4–6 pairs, propodeum with 1–3 pairs, petiole with 0–3 pairs, postpetiole with 0–3 pairs of hairs. First gastral tergite consistently hairless. Eyes fairly large, within the HW range given above the maximum eye diameter is 0.46–0.58, about  $0.20\text{--}0.22 \times \text{HW}$ . CI range is 103–110.

Holotype worker, **Niger**: Azanyares, iii.1979 (*J. Newby*) (BMNH).

Paratypes. 12 workers with same data as holotype (BMNH; MCZ, Cambridge; NM, Basle; MHN, Geneva).

Non-paratypic material examined. **Mali**: Tessalit (*P. Room*).

Among the species with hairless or near hairless first gastral tergite *collingwoodi* is distinguished by having propodeal hairs present, having an extensively sculptured head, and having persistent propodeal spines. *M. luebberti*, which also has the head sculptured everywhere, is reddish in colour and lacks propodeal hairs and spines. Also, the regular cephalic sculpture is more extensively developed than in *collingwoodi*. *M. angularis* also lacks propodeal hairs and spines and has the head weakly or not sculptured. *M. galla*, which frequently develops propodeal lobes or teeth and which also has propodeal hairs present, lacks the characteristic cephalic sculpture of *collingwoodi*.

The closest relatives of *collingwoodi* are, however, not to be found among the other sub-Saharan African species but among the members of the *aegyptiacus*-group, of which *collingwoodi* seems to be the only Afrotropical species.

### *Messor decipiens* Santschi stat. n.

(Fig. 28)

*Stenamma* (*Messor*) *barbarum* r. *capense* var. *decipiens* Forel, 1905: 177 [unavailable name]; Santschi, 1917:

94 [*Messor capense* st. *decipiens*, first available use of name]. Syntype workers, females, SOUTH AFRICA:

Natal (*Wroughton*) (MHN, Geneva) [examined].

*Messor barbarus* subsp. *capensis* var. *proba* Forel, 1911a: 266. Holotype worker, SOUTH AFRICA: Orange

Free State, Bothaville (*H. Brauns*) (MHN, Geneva) [examined]. [Unavailable name.]

*Messor arcistriatus* Santschi, 1928: 202. Holotype worker, SOUTH AFRICA: Natal (*Wroughton*) (NM, Basle) [examined]. **Syn. n.**

MEDIUM TO LARGE WORKER, HW 2.64– > 4.20.

Answering to the description of *capensis* in most particulars. In the HW range quoted above the maximum diameter of the eye is 0.44–0.66, about  $0.14\text{--}0.18 \times \text{HW}$ , and the CI range is 107–121, the largest workers known for *decipiens* thus being somewhat larger and broader headed than those known for *capensis*. Propodeum in profile with the dorsum usually meeting the declivity in a right-angle, which may project into a broad but quite short lobe or tooth of variable shape and size; rarely the propodeum merely narrowly rounded. In contrast the propodeum of *capensis* is generally rounded, only seldom with dentiform prominences. Sculpture of head basically the same as in *capensis* but here the rugae tending to be more sharply developed and more widely separated, although there is some variation. Spaces between the rugae usually smooth, frequently glossy, much less commonly with traces of punctulate ground-sculpture. Head usually obviously red, contrasting in colour with the alitrunk and gaster which are darker. In smaller workers this distinction in colour is not nearly so obvious and at the lower limit of the size range considered here (and smaller) the ant may be unicoloured.

Very closely related to *capensis* and *piceus*, *decipiens* is separated from the former only on the weak characters mentioned above. It is even closer to the latter, being distinguished only by the colour of the hairs as noted in the key, and the fact that *piceus* does not have the head distinctly different in colour from the alitrunk in large workers. It seems very probable that more extensive collecting of this complex will reveal that these forms represent but a single species.

#### MATERIAL EXAMINED

**Zimbabwe:** Bulawayo (G. Arnold). **Botswana:** Ghazi (J. Maurice). **Lesotho:** Mafeteng (R. Crawshaw). **South Africa:** Natal, Weenen (G. Arnold); Natal (Wroughton); Durban (G. Arnold); Drakensberg, Van Reenen (R. E. Turner); Mkuzi Reserve (C. P. Peeters); no loc. (ex coll. F. Smith); Transvaal, Brakfontein (Lingnau); Vryburg (G. Arnold); Shiluvane (Junod); Orange Free State, Bothaville (H. Brauns).

### *Messor denticornis* Forel

(Fig. 29)

*Messor denticornis* Forel, 1910a: 14. Syntype workers, female, male, SOUTH WEST AFRICA: Lüderitzbucht, 1903 (L. Schultze) (MHN, Geneva; BMNH) [examined].

*Messor denticornis* var. *parvidens* Forel, 1910a: 15. Syntype workers, SOUTH WEST AFRICA: Kubub (L. Schultze) (MHN, Geneva) [examined]. **Syn. n.**

*Messor denticornis* var. *brunni* Forel, 1910b: 444. Syntype workers, SOUTH WEST AFRICA: no loc. (Brunn); and SOUTH AFRICA: Cape Prov., Steekstow (Wartmann) (MHN, Geneva) [examined]. **Syn. n.**

MEDIUM TO LARGE WORKER, HW 2.48– > 3.10.

Anterior clypeal margin usually evenly convex medially, only rarely with the faintest trace of a central indentation. With the head in full-face view the sides more or less straight and diverging anteriorly, but sometimes the sides more nearly parallel. Occipital margin broadly but shallowly concave, this feature fading out in smaller workers where the margin is approximately transverse. In HW range 2.48–3.16 the maximum diameter of the eye is 0.56–0.70, about  $0.21\text{--}0.25 \times \text{HW}$ , and the CI range is 100–106. Propodeum in profile relatively long and low, resembling that of *striatifrons* (Fig. 32). Propodeal armament very variable, the junction of dorsum and declivity being rounded, acutely angled or distinctly bidentate. These variants are commonly seen in the same series and are in fact shown by the type-series of *denticornis* itself. Basic sculpture of the head finely densely packed parallel longitudinal rugulae with punctulate ground-sculpture between them. Frequently the sculpture much reduced, either by suppression of the ground-sculpture so that the rugulae stand out from a smooth surface or by reduction of the rugulae in number and intensity so that the head is mostly or wholly punctulate. In smaller individuals the surface may be almost smooth. Dorsal alitrunk rugulose to rugose, the sculpture sometimes partially or totally effaced from the pronotum. First gastral tergite smooth and shining or at most with faint superficial pattering. All dorsal surfaces of head and body with numerous standing hairs. Colour mid-brown to black, sometimes with the gaster darker than the head and alitrunk.

A distinctive species amongst those with uniformly distributed pilosity on the first gastral tergite, *denticornis* is immediately isolated by its relatively large eyes. Only a few workers of *tropicorum* approach even the lower end of its eye size range but in the latter species the clypeus has a conspicuous posteromedian tumulus or welt and the propodeum is shorter and higher in profile than is the case in *denticornis*.

#### MATERIAL EXAMINED

**Botswana:** Ghanzi (E. S. Ross & A. R. Stephen). **South West Africa:** Okaukuejo (E. S. Ross & R. E. Leech); Spitzkoppe (E. S. Ross & K. Lorenzen); Ababis (R. W. Tucker); Berseba (L. O. Sordahl); Lüderitzbucht (L. Schultze); Kubub (L. Schultze). **South Africa:** Cape Prov., Oudtshorn (B. Brunhuber); Strydenburg (M. Patterson); Steekstow (Wartmann).

### *Messor galla* (Mayr)

*Stenamma* (*Messor*) *barbarum* subsp. *caduca* var. *galla* Emery, 1895a: 179 [unavailable name]; Mayr, 1904: 5 [*Stenamma* (*Messor*) *barbarum* var. *galla*, first available use of name]; Santschi, 1928: 201 [*galla* raised to species]. Holotype worker, ETHIOPIA: Alto Duau, Boran Galla, v. 1893 (V. Bottego) (MCSN, Genoa) [examined].

*Messor barbarus* subsp. *semirufus* var. *rufa* Forel, 1910c: 250. Syntype workers, ETHIOPIA: Nefassit (K. Escherich) (MHN, Geneva) [examined]. [Unavailable name.]

- Messor barbarus* st. *galla* var. *triempresa* Santschi, 1917: 92. Syntype workers, CHAD: Baguirmi, Techeckna; ETHIOPIA: no loc.; SENEGAL: Casamance (*Clavaux*). (NM, Basle) [examined]. [Unavailable name.]
- Messor barbarus* st. *latinoda* Santschi, 1917: 93, fig. 2. Syntype workers, 'EAST AFRICA': no loc. (*Reichensperger*) (NM, Basle) [examined]. **Syn. n.**
- Messor barbarus* r. *semirufus* var. *rufula* Forel, 1918: 156. [Unnecessary replacement name for *rufa* Forel, 1910c: 250, above.] [Unavailable name.]
- Messor barbarus* subsp. *galla* var. *armata* Emery, 1922b: 98. Syntype workers, GHANA: no loc. (MCSN, Genoa) [examined]. [Unavailable name.]
- Messor galla* st. *nobilis* Santschi, 1928: 201. Syntype workers, female, ETHIOPIA: Bisa Tint, 1200 m (*Reichensperger*) (NM, Basle) [examined]. **Syn. n.**
- Messor galla* var. *airensis* Bernard, 1950: 286, Syntype workers, NIGER: Air Dist., Dabaga, 600 m; Mt Baguezans, 1500 m; Agadez, 525 m (*Chopard & Villiers*). [Not found in MNHN, Paris, presumed lost.] **Syn. n.**

MEDIUM TO LARGE WORKER, HW 2.40– > 3.70.

Median portion of clypeus with anterior margin broadly but shallowly concave to more or less entire. With the head in full-face view the sides very shallowly convex to roughly straight, usually slightly convergent in front of the eyes. Occipital margin broadly indented medially. In HW range 2.40–3.76 the maximum diameter of the eye 0.44–0.68, about 0.17–0.20 × HW, and the CI range 102–114. Propodeum showing great variation; frequently with the dorsum rounding into the declivity but sometimes with a pair of broad teeth or lamellae. Between these two extremes is a range of intermediates including forms with a narrow to broad rim or flange following the curve of the surface, forms with a small to large salient angle and forms with the angle or flange projecting to various degrees. Dorsum of head smooth and shining, away from the median strip sculptured only with very widely scattered small pits or a faint superficial patterning. Median strip of head behind clypeus with longitudinal rugular sculpture which usually extends back at least as far as the level of the posterior margins of the eyes, and often distinctly further back than this; only very rarely is the rugular strip shorter. Intensity of rugulae on the median strip very variable and the width of the strip not usually exceeding the width across the frontal lobes and often narrower, only rarely slightly wider. Pronotum dorsally with weak transverse rugulae which may sometimes be very feeble or even partially effaced. Mesonotum varying from almost smooth to faintly rugulose. Propodeal dorsum generally sharply transversely rugose but in some samples the rugae diagonal, irregular or interrupted. First gastral tergite unsculptured but often showing a faint superficial patterning. With the head in full-face view the sides without projecting hairs, the occipital margin with 0–4 hairs on each side of the median impression. Generally hairs are present occipitally, specimens with zero count are very few and may be the result of abrasion. Dorsum of head sparsely hairy, the psammophore conspicuous ventrally. Parts of dorsal alitrunk with pilosity as follows; pronotum with 0–4 pairs, mesonotum with 4–10 pairs, metanotal groove with 1–2 pairs at least in large workers, propodeum with 1–5 pairs. Petiole with 1–3, postpetiole with 3–6 pairs of hairs. First gastral tergite without hairs or with a sparse transverse row at the extreme apex of the sclerite. Ventral surfaces of hind femora usually with hairs all along the shaft but in some they are denser proximally than distally. Colour reddish brown to blackish brown, usually with the gaster darker than the head and alitrunk. In some samples the head slightly more reddish than the alitrunk.

Without doubt the commonest, most successful and most widely distributed *Messor* species in the northern half of sub-Saharan Africa, *galla* ranges throughout the Sahelian zone across the entire width of the continent. On the eastern side it is found as far south as Kenya, and in the west it occurs coastally as well as in the drier northern parts of the West African states. Of the four species in the region which lack dense gastral pilosity *galla* is separated from *collingwoodi* and *luebberti* by the extensive cephalic sculpturing of the last two. The separation of *galla* from its closest African relative, *angularis* of Kenya, is tabulated under that name. Some aspects of the biology of *galla* have been investigated by Lévieux & Diomande (1978) and Lévieux (1979).

#### MATERIAL EXAMINED

**Ethiopia:** Addis Ababa, Entoto Hills (*K. Guichard*); Addis Ababa (*V. O. De Massi*); Boran Galla (*V. Bottego*); Lake Zwai, Sucsuci (*J. O. Cooper*); Wachacha Ravine (*H. Scott*); Bisa Tint (*Reichensperger*); Mt Monagasha (*Cloudsley-Thompson*); Gondar (*Cloudsley-Thompson*); Tisisat Falls (*Cloudsley-Thompson*); Holetta; Dessie (*E. S. Ross*); Nefassit (*K. Escherich*); Barentu (*Müller*); Tessenei (*Müller*); Amba Derho (*Müller*); Om Agar (*Müller*); Ghinda (*K. Escherich*); no loc. (*G. McCreagh*). **Somali Republic:** Alabla Balleh (*P. E. Glover*). **Kenya:** Nakuru (*N. A. Weber*); Marsabit (Rift Valley Expd.); Tsavo East (*J. Darlington*); Maralal (*M. E. Irwin & E. S. Ross*). **Sudan:** Kadugli (*C. Sweeny*); Khartoum (*N. A. Weber*); Khartoum (*R. Cotton*); Khartoum (*H. H. King*); Kulme (*H. Lynes*); Lake Kellek (*C. Sweeny*); Dilling-El Obeid Rd. (*C.*

Sweeny); Sennar (*B. Hocking*); Imatong Mts (*N. A. Weber*); Equatoria (*N. A. Weber*). **Niger**: Niamey (*P. Room*); Niamey (*J. Lévieux*); Ayorou (*P. Room*); Assode (*J. Lévieux*). **Mali**: Gao (*B. Malkin*); Anefis (*P. Room*). **Upper Volta**: Ougadougou (*P. Room*); Banfora (*Betbeder*). **Senegal**: Dakar (*W. L. Brown*); Dakar (*N. L. H. Krauss*); Casamance (*Clavaux*). **Ivory Coast**: Korhogo (*R. Lucius*); Ferkessedougou (*J. Lévieux*). **Ghana**: Lawra (*W. Cook*); Bolgatanga (*P. Room*); Tamale (*Anipare*); Tumu (*P. Room*); Navrongo (*C. A. Collingwood*); Dawhwenya (*D. Leston*); Dawhwenya (*C. A. Collingwood*); Nyankpala; Prampram (*W. Belfield*); Achimota (*W. Belfield*); Nungua (*W. Belfield*); Accra (*C. A. Buckman*). **Nigeria**: Kalkala (*F. D. Golding*); Illela (*Lelean*); Katsina (*J. T. Medler*); Zaria (*A. S. Ahman*); Maiduguri (*E. R. Ross & K. Lorenzen*).

*Messor incisus* Stitz nomen dubium

*Messor incisus* Stitz, 1923: 149. Holotype female, SOUTH WEST AFRICA: Okosongomingo Farm, vii–viii.1912 (*H. Thomsen*) [not found in MNHU, Berlin, presumed lost].

Described from a single female which has since been lost, the identity of *incisus* cannot be ascertained accurately at present. In his original description of *incisus* Stitz compares it to the female of *denticornis*. So few females of *denticornis* are known that it is possible for *incisus* to fall within the range of variation of that species. On the other hand *incisus* may be the female of *striatifrons* or indeed be a separate species. Considerably more samples of *Messor* females will be necessary before any attempt at placing *incisus* can be made.

*Messor luebberti* Forel stat. n.

*Messor barbarus* subsp. *luebberti* Forel, 1910a: 13. Syntype workers, SOUTH WEST AFRICA: Okahandja (*Peters*), and no loc. (*Lübbert*) (MHN, Geneva) [examined].

MEDIUM TO LARGE WORKER, HW 2.00– > 3.00.

Anterior clypeal margin flattened to slightly indented medially. With the head in full-face view the sides more or less straight, roughly parallel or weakly convergent anteriorly. Occipital margin distinctly indented medially in large workers but the indentation becoming obliterated with reduced size. In HW range 2.00–3.12 the maximum diameter of the eyes 0.38–0.50, about 0.15–0.18 × HW, and the CI is 100–112. With the propodeum in profile the dorsum rounding narrowly into the declivity to meeting the declivity in a right-angle; propodeal armament never developed. Dorsum of head everywhere finely and densely longitudinally rugulose, the rugulae approximately parallel and becoming finer away from the mid-dorsal strip. Ground-sculpture of minute punctulation is present between the rugulae but this is less conspicuous in some samples than in others. Pronotal dorsum weakly and faintly to quite strongly transversely rugulose, but always with a fairly distinct punctulate component between the rugulae. Mesonotum smooth with only vestigial traces of sculpture to irregularly granular, only rarely with a regular component. Propodeal dorsum transversely rugulose to rugose, with punctures between the rugulae. First gastral tergite unsculptured except for the fine superficial reticular patterning which is usual in the genus. With the head in full-face view the sides and occipital margin lacking projecting hairs. Projecting hairs very sparse to absent on dorsum of head but present on mouthparts and between frontal lobes. Psammophore strongly developed. On dorsal alitrunk the pronotum with 0–4 pairs of hairs, the mesonotum with 2–6 pairs; the propodeum, petiole and postpetiole lacking hairs. First gastral tergite without hairs or at most with 2–3 at the extreme apical margin of the sclerite. Colour usually red with a blackish gaster but in some the gaster the same shade of red as the head and alitrunk. Shade of red of head and alitrunk varying from bright, almost orange, to very dull.

This very distinctive species is extremely widespread in the southern half of the African continent. It is immediately recognizable by its strongly sculptured head and very reduced pilosity. Of the sparsely hairy species of Africa only *collingwoodi* from Mali and Niger has the head anywhere near as strongly sculptured as *luebberti*, but in that species the propodeum has hairs and the junction of propodeal dorsum and declivity is armed with a pair of short spines.

MATERIAL EXAMINED

**Tanzania**: Dodoma (*A. Loveridge*). **Zimbabwe**: Bulawayo (*G. Arnold*); Springvale (*G. Arnold*). **Botswana**: Damara Pan (*G. U. Son*); Kuke Pan (*G. U. Son*); Gomodimo (*G. U. Son*); Xani Pan (*A. Russell-Smith*). **Angola**: Cahama (*E. S. Ross & R. E. Leech*). **South West Africa**: Gemsbok Pan (*G. U. Son*); Okahandja (*Peters*); no loc. (*Lübbert*); Windhoek (*Ross & Stephen*). **South Africa**: Transvaal, Shiluvane (*Junod*); Malagieskraal (*Lingnau*); Pretoria; Pietersburg (*E. S. Ross & R. E. Leech*).

*Messor piceus* Stitz

*Messor piceus* Stitz, 1923: 150. Syntype workers, female, SOUTH AFRICA: Transvaal (*Ulrich*) [not found in MNHU, Berlin, presumed lost].

MEDIUM TO LARGE WORKER, HW 3.28– > 4.20.

Answering to the description of *capensis*, but differing mainly in the colour of the body pilosity which is white to yellowish in *capensis* but very deep red-brown to blackish in *piceus*. Apart from this the anterior clypeal margin is indented medially in *piceus*; the propodeum varies from narrowly rounded through right-angled to broadly and bluntly dentate, and the largest known workers are larger than those of *capensis*. In the HW range 3.28–4.20 the maximum diameter of the eye is 0.54–0.64, about 0.15–0.17 × HW, and the CI range is 106–119. The maximum known for *capensis* is HW 3.44 but this may not be the largest worker of the species, merely the largest available for study at present. Relative size of eye and CI fall within the range of *capensis*.

Unfortunately the type-series of *piceus* appears to be lost, but three short series from Transvaal match the original description tolerably well and show the dark pilosity noted by Stitz. I am therefore applying the name *piceus* to these specimens and to two other short series, from Natal and Botswana, noted under material examined.

*M. piceus* is a very closely related to *capensis* and *decipiens*; these three names may ultimately prove to represent only a single species.

## MATERIAL EXAMINED

**Botswana:** Gomodimo (*Vernay-Lang*). **South Africa:** Natal, Pietermaritzburg (*Akerman*); Transvaal, Sabie; Kimberley (*G. Arnold*); Oliphants River, Grootdraai (*H. Lang*).

*Messor regalis* (Emery)

*Cratormyx regalis* Emery, 1891: 572, pl. 15, fig. 16. LECTOTYPE female, NIGERIA: Benue (*Staudinger*) (MCSN, Genoa), here designated [examined].

*Cratormyx regalis* var. *rubea* Santschi, 1913: 308. Holotype worker, BENIN REPUBLIC: no loc. (*Le Moult*) (NM, Basle) [examined]. **Syn. n.**

*Cratormyx sculpturatus* Stitz, 1916: 377, fig. 2. Syntype workers, CONGO: Fort Possel-Fort Crampel, xi.1910 (*Schubotz*); and Chûtes de la Nana, 'bei Fort Crampel', 7.xi.1910 (*Haberer*) (MNHU, Berlin) [examined]. **Syn. n.**

*Messor regalis* (Emery) Emery, 1922a: 357.

MEDIUM TO LARGE WORKER, HW 3.00– > 4.50.

Median portion of clypeus with anterior margin shallowly convex to somewhat flattened, irregular because of strong sculpture but not strongly impressed-concave. In HW range 3.00–4.40 the maximum diameter of the eye is 0.48–0.70, about 0.16–0.17 × HW, and the CI range is 109–115. With the head in full-face view the sides in front of the eyes more or less straight, roughly parallel or slightly convergent anteriorly. Behind the eyes the sides rounding very broadly and evenly into the occipital margin; the latter usually shallowly indented medially. Propodeum armed with a pair of short triangular spines. Dorsum of head densely sculptured everywhere with coarse parallel longitudinal rugulae. On the median strip behind the frontal lobes the rugulae tend to run straight back on the head; on each side of this strip they diverge towards the occipital corners. Pronotal dorsum coarsely sharply and irregularly rugose, frequently reticulate-rugose in places and generally with a strip of strong transverse rugae immediately behind the cervical shield. Remainder of dorsum and also sides of alitrunk strongly and generally sharply rugose everywhere, the sculpture stronger than on the dorsum of the head. Tergal portions of petiole and postpetiole very closely and coarsely irregularly rugose, the surfaces with a crumpled and wrinkled appearance. First gastral tergite rugulose to sharply costulate basally, the sculpture extending at least over the basal third of the sclerite and becoming finer posteriorly. All dorsal surfaces of head and body with numerous standing hairs, pilosity also dense on legs. With the head in full-face view projecting hairs are present on the sides behind the eyes, on the broad curve of the occipital corners and on the occipital margin itself. One or two hairs usually also project from the sides in front of the eyes. Psammophore conspicuously developed. Colour dull red to reddish brown, the gaster sometimes with an orange tint.

A species of West and Central Africa *regalis* is easily characterized by its blanketing coarse rugose sculpture. No other species in the region has sculpture approaching that found in *regalis*. This feature coupled with the dense pilosity and persistent propodeal spines renders the species

quickly recognizable. Only *cephalotes* and *regalis* have extensive sculpture on the first gastral tergite; characters separating the two are given under *cephalotes*.

Some aspects of the biology of *regalis* have recently been investigated by Lévieux & Diomande (1978) and Lévieux (1979).

#### MATERIAL EXAMINED

**Nigeria:** K. State, N. Bussa (*J. T. Medler*); Mokwa (*C. Longhurst*); Olokemeji (*Bridwell*); Benue (*Staudinger*). **Benin Republic:** no loc. (*Le Moul*). **Congo:** Fort Crampel (*Schubotz*).

#### *Messor ruginodis* Stitz stat. n., nomen dubium

*Messor barbarus* st. *ruginodis* Stitz, 1916: 374, fig. 1. Syntype workers, CONGO: Fort Crampel, xi.1910–6.i.1911 (*Schubotz*) [not found in MNHU, Berlin, presumed lost].

Apart from the very distinctive *regalis* this is the only other species of *Messor* recorded from the Congo. It is possible to decide from Stitz's description that *ruginodis* is related to *capensis* and its allies, but further placement cannot be attempted without the types as the description alone is not good enough. It must suffice for the present to state that, apart from *regalis*, no *Messor* species is known to extend its range into the Congo, so *ruginodis* remains an enigma.

As the species, whatever it really is, is definitely not closely related to *barbarus*, I have raised it to species-level here.

#### *Messor striatifrons* Stitz stat. n.

(Figs 27, 32)

*Messor denticornis* var. *striatifrons* Stitz, 1923: 149. Syntype workers, SOUTH WEST AFRICA: no loc. (*Scheben*) (MNHU, Berlin) [examined].

MEDIUM TO LARGE WORKER, HW 2.84– > 3.75.

Anterior clypeal margin usually shallowly convex medially but sometimes a weak central indentation of the margin is present. With the head in full-face view the sides convex. Generally the convexity is distinct (Fig. 27) in larger workers but tends to be less marked in smaller individuals; infrequently the reverse is true and medium sized workers show the convexity more strongly than larger specimens. Occipital margin shallowly indented medially, the indentation best developed in large workers and slowly disappearing with decrease in size. Within the HW range 2.84–3.76 the maximum diameter of the eye is 0.52–0.68, about 0.16–0.18 × HW, and the CI range is 104–114. Propodeum in profile relatively long and low (Fig. 32), usually rounded at the junction of dorsum and declivity but quite frequently right-angled or projecting into a broad short tooth which is really no more than a projection of the right-angle. Dorsum of head sculptured with extremely fine dense longitudinal rugulae which in the strongest sculptured individuals are very close packed. Spaces between the rugulae with fairly conspicuous ground-sculpture of fine punctures. In medium sized workers, and quite frequently in maximum sized workers also, the sculpture on the dorsal head is modified by a weakening of the rugular component and an intensification of the punctures, so that in some the rugular component is suppressed and the head appears reticulate-punctate everywhere or almost everywhere. Dorsal alitrunk rugulose, the direction of the sculpture variable but usually stronger on the propodeum than elsewhere. First gastral tergite unsculptured or at most with the faint superficial patterning so commonly seen in this genus. All dorsal surfaces of head and body with numerous standing hairs; evenly distributed hairs conspicuous on first gastral tergite. Colour medium to dark brown, commonly uniform but often with the gaster darker, blackish brown.

A fairly distinctive member of the group of species centring on *capensis*, *striatifrons* is characterized by its relatively long low propodeum and convex head sides. The shape of the head is not duplicated in other African species but *denticornis* has a similarly proportioned propodeum. However, in this last-named species the eyes are larger, with a range of 0.21–0.25 × HW.

#### MATERIAL EXAMINED

**South Africa:** Cape Prov., Victoria West (*G. Arnold*); Steinkop (*G. Arnold*); Springbok (*E. S. Ross & R. E. Leech*); Picketberg (*E. S. Ross & R. E. Leech*); Citrusdal (*E. S. Ross & R. E. Leech*); Papendrop (*E. S. Ross & K. Lorenzen*); Clanwilliam (*E. S. Ross & R. E. Leech*). **South West Africa:** no loc. (*Scheben*).

*Messor tropicorum* Wheeler stat. n.

*Messor barbarus* subsp. *capensis* var. *tropicorum* Forel, 1910b: 444 [unavailable name]; Wheeler, 1922: 805 [*capensis* var. *tropicorum*, first available use of name]. Syntype workers, ANGOLA: Mossamedes (*Baum & Van der Kellen*) (MHN, Geneva) [examined].

*Messor denticornis* var. *laevifrons* Stitz, 1923: 148. Syntype workers, SOUTH WEST AFRICA: Usakos, iv.-vi.1911; and Grootfontein, 7-11.vi.1911 (*W. Michaelsen*) (MNHU, Berlin) [examined]. **Syn. n.**

*Messor braunsi* var. *nigriventris* Stitz, 1923: 150. Syntype workers, SOUTH WEST AFRICA: Grootfontein, 7-11.vi.1911 (*W. Michaelsen*) (MNHU, Berlin) [examined]. **Syn. n.**

MEDIUM TO LARGE WORKER, HW 3.00- > 3.80.

Anterior clypeal margin entire or at most with a feeble median indentation. With the head in full-face view the sides approximately straight, more or less parallel or feebly diverging anteriorly. Occipital margin usually broadly and shallowly concave but this becomes less apparent with decreased size. Centre of posterior half of clypeus, between the frontal lobes, with a conspicuously raised tumulus or welt in large workers, this feature decreasing in intensity with reduced size and not present in smaller workers. In the HW range 3.00-3.84 the maximum diameter of the eye is 0.64-0.72, about 0.19-0.21 × HW, and the CI range is 102-111. Propodeum in profile relatively short and high, like that of *capensis* (Fig. 31). Propodeal dorsum either rounding into declivity, or meeting it in a right-angle, or armed with a pair of short triangular teeth; variation occurs within series. Dorsum of head sculptured with narrow fine longitudinal rugulae. In strongest sculptured individuals the rugulae are dense and conspicuous, but often they are much reduced or partially to entirely effaced away from the central strip. Between the rugulae the ground-sculpture is of a fine superficial punctulation, often completely effaced. Dorsal alitrunk rugulose to rugose, the sculpture frequently weak on the pronotum or even absent in places. First gastral tergite unsculptured or at most with a faint superficial reticular pattering. All dorsal surfaces of head and body with numerous conspicuous standing hairs. Head and alitrunk reddish brown, the gaster darker.

Larger workers of *tropicorum* are quickly isolated by their possession of a strong prominent welt or tumulus posteromedially on the clypeus, but this character fades with reduced worker size. The eyes are quite large, approaching the lower limit of the range seen in *denticornis*, but in the latter the propodeum is longer and lower in profile.

## MATERIAL EXAMINED

**South West Africa:** Kabiras (*R. W. E. Tucker*); Usakos (*W. Michaelsen*), Grootfontein (*W. Michaelsen*). **Angola:** Mossamedes (*Baum & Van der Kellen*).

*CATAULACUS* F. Smith

*Cataulacus* F. Smith, 1853: 225. Type-species: *Cataulacus taprobanae* F. Smith, 1853: 225, by subsequent designation of Bingham, 1903: 120.

For diagnosis of genus, current synonymy and generic revision see Bolton (1974). For some time I have been unhappy about the treatment which I gave to some species in the *C. tenuis*-group of Africa (Bolton, 1974). It has become apparent, with the acquisition of more material and with further experience of the group, that I was wrong to synonymize some of the names. The opportunity to rectify these mistakes now presents itself and the changes from the previous system are summarized below. Following this six new species are described and a revised key to the Afrotropical species is provided which reflects these additions and changes, and which includes also the two African species recently described by Snelling (1979). The new key only deals with the Afrotropical fauna; it excludes the Malagasy species which were incorporated in the former (1974) key. For identification of such species the reader is referred back to the earlier study.

## Key to species (workers)

- 1 Dorsal alitrunk without standing hairs of any description or at most with only 1-2 very short hairs at the highest point of the pronotum. Generally hairs absent from alitrunk but rarely sparse strongly appressed hairs may be present . . . . . 2
- Dorsal alitrunk with numerous standing hairs which are usually conspicuous. If the standing hairs are very short they are more or less evenly distributed over the dorsum and are not restricted to the highest point of the pronotum. . . . . 10



- 2 Propodeum completely unarmed, without trace of spines or teeth. (Zaire) . . . . . *inermis* Santschi
- Propodeum armed with a pair of spines or teeth . . . . . 3
- 3 Dorsal alitrunk strongly sulcate throughout. Appressed hairs present on the dorsal alitrunk. (Ghana) . . . . . *adpressus* Bolton
- Dorsal alitrunk reticulate-punctate to reticulate, usually also with fine rugulae or a rugoreticulum present; never sulcate. Appressed hairs absent from dorsal alitrunk . . . . . 4
- 4 Petiole dorsally strongly transversely rugose or sulcate everywhere . . . . . 5
- Petiole dorsally variously sculptured but never transversely strongly rugose or sulcate . . . . . 7
- 5 First gastral sternite laterobasally with a longitudinal margination or carina which parallels the laterobasal margination of the first tergite. Femora of hind legs not excessively anteroposteriorly compressed . . . . . 6
- First gastral sternite laterobasally without a longitudinal margination or carina which parallels the laterobasal margination of the first tergite. Femora of hind legs strikingly anteroposteriorly compressed, narrow and very deep. (Sierra Leone, Cameroun, Equatorial Guina, Congo, Zaire, Uganda) . . . . . *kohli* Mayr
- 6 Sides of head behind eyes irregular, either denticulate, crenulate or otherwise jagged. Relatively broader-headed species, CI > 125, the head strongly broadened behind the eyes. Laterally projecting hairs on sides of head behind eyes long and conspicuous. (Sierra Leone, Ghana, Nigeria, Cameroun, Uganda, Zaire, Zambia) . . . . . *huberi* André
- Sides of head behind eyes regular, smooth, neither denticulate nor crenulate. Relatively narrower-headed species, CI 120 or less, the head not strongly broadened behind the eyes. Laterally projecting hairs on sides of head behind eyes minute and inconspicuous or absent. (Ghana, Nigeria, Cameroun, Uganda, Congo, Zaire) . . . . . *egenus* Santschi
- 7 Petiole and postpetiole in dorsal view strongly longitudinally sulcate. Postpetiole dorsally divided into two projecting lobes by a deep median longitudinal cleft. (Cameroun, Zaire) . . . . . *lobatus* Mayr
- Petiole and postpetiole in dorsal view not strongly longitudinally sulcate. Postpetiole dorsally not divided into two projecting lobes by a deep median longitudinal cleft . . . . . 8
- 8 Lateral pronotal margination with 2 teeth. Dorsal and lateral surfaces of petiole and postpetiole with numerous tubercles and small angular prominences, presenting a multi-peaked and irregular surface. (Cameroun, Congo, Zaire, Kenya) . . . . . *pullus* Santschi
- Lateral pronotal margination with 0–1 teeth. Dorsal and lateral surfaces of petiole and postpetiole not equipped with tubercles and small angular prominences . . . . . 9
- 9 With the head in full-face view the lateral margins behind the eyes without a row of short projecting hairs. Lateral pronotal margination without teeth. (Ghana, Cameroun, Guinea, Zaire) . . . . . *tardus* Santschi
- With the head in full-face view the lateral margins behind the eyes with a row of short projecting hairs. Lateral pronotal margination with a single tooth on each side, close to the anterior pronotal corner. (Zaire) . . . . . *theobromicolus* Santschi
- 10 Petiole and postpetiole strongly transverse, much flattened dorsoventrally and without nodes, both very broadly thickly V-shaped in dorsal view. Propodeum armed only with a pair of small teeth or tubercles which are inconspicuous. (Sierra Leone, Liberia, Ghana, Nigeria, Cameroun, Zaire) . . . . . *mocquersyi* André
- Petiole and postpetiole nodiform, not strongly transverse nor flattened, not broadly V-shaped in dorsal view. Propodeal spines well developed and conspicuous . . . . . 11
- 11 Hairs on clypeus and usually also on remainder of cephalic dorsum bizarre, strongly clavate or stalked-suborbicular. In most the apex of each hair is very strongly swollen whilst the stem is narrow; sometimes the stem may be short or very short . . . . . 12
- Hairs on clypeus and remainder of cephalic dorsum simple, usually stout cylindrical and blunt but sometimes very short and stubble-like, sometimes elongate and fine and occasionally gradually increased in thickness from base to apex, but not strongly clavate or stalked-suborbicular . . . . . 20
- 12 With the alitrunk in dorsal view the pronotal margin on each side without an unbroken series of denticles which project laterally between the pronotal corner and the site of the promesonotal junction . . . . . 13
- With the alitrunk in dorsal view the pronotal margin on each side with an unbroken series of denticles which project laterally between the pronotal corner and the site of the promesonotal junction . . . . . 15
- 13 First gastral tergite regularly longitudinally sulcate throughout. (Cameroun) . . . . . *jacksoni* (p. 360)

- First gastral tergite reticulate-punctate or with fine rugulae overlying reticulate-punctate ground-sculpture, never longitudinally sulcate . . . . . 14
- 14 Propodeal dorsum longitudinally rugulose. (Nigeria, Cameroun) . . . . . *vorticus* Bolton
- Propodeal dorsum transversely rugose. (Nigeria) . . . . . *boltoni* Snelling
- 15 Bizarre hairs on dorsum of head behind clypeus with a very short basal stem, appearing stud-like, the swollen apices set very close to the cephalic surface . . . . . 16
- Bizarre hairs on dorsum of head behind clypeus with an elongate basal stem, never short and stud-like, the swollen apices conspicuously raised well clear of the cephalic surface . . . . . 17
- 16 Larger species, HW 0.80 or more. (Tanzania, Zimbabwe, Angola, South Africa) *brevisetosus* Forel
- Smaller species, HW < 0.80. (Ivory Coast, Ghana, Cameroun, Uganda, Kenya, Tanzania, Angola) *jeanneli* (p. 358)
- 17 Dorsal alitrunk with weak rugulose sculpture and a blanketing dense reticulate-punctate ground-sculpture which is very conspicuous between the rugulae, the surface matt and dull . . . . . 18
- Dorsal alitrunk with strong dense rugose sculpture the spaces between which are unsculptured or at most contain some feeble superficial ground-sculpture, the surface glossy . . . . . 19
- 18 Denticles on lateral pronotal margins minute and inconspicuous in dorsal view, much smaller than the tooth at the pronotal corner. (Cameroun) *satrap* (p. 363)
- Denticles on lateral pronotal margins large and conspicuous, at least as large as the tooth at the pronotal corner, sometimes larger. (Ghana, Nigeria, Cameroun, Zaire) *lujae* (p. 358)
- 19 Smaller species, HW 0.80 or less. Body hairs relatively short (Fig. 34). Basal quarter of first gastral tergite without strong rugulae, either punctate or with feeble rugulae caused by alignment of punctures. Propodeal spines in profile evenly feebly curved. (Ghana, Nigeria) *moloch* (p. 361)
- Larger species, HW > 0.90. Body hairs relatively long (Fig. 33). Basal quarter of first gastral tergite with strong longitudinal rugulae which are independent of the underlying puncturation. Propodeal spines in profile with basal third elevated and apical two-thirds recurved. (Cameroun) *centrurus* (p. 359)
- 20 Erect hairs on dorsal surfaces of head, alitrunk and gaster abundant, dense, very long narrow and fine, curved or even sinuate, the entire ant with a softly pilose appearance rather than the bristly appearance usually associated with this genus . . . . . 21
- Erect hairs on dorsal surfaces of head, alitrunk and gaster relatively sparse, short broad and blunt, coarse and usually straight, the entire ant with a bristly or stubbly appearance . . . . . 22
- 21 Propodeal dorsum longitudinally rugulose or rugose. Larger species, HL > 0.90, HW > 0.85. (Ghana, Cameroun, Angola) *elongatus* Santschi
- Propodeal dorsum transversely rugulose. Smaller species, HL < 0.90, HW < 0.85. (Zaire) *pilosus* Santschi
- 22 Head relatively broad or very broad, the eyes small, CI > 112, OI < 30. In dorsal view the posterolateral portion of the pronotal margin produced into a large spine or triangular prominence. Propodeal spines long and very strong, not dorsoventrally flattened . . . . . 23
- Head relatively narrow and eyes larger, CI 110 or less, OI > 32. In dorsal view the posterolateral portion of the pronotal margin usually armed with a short tooth or a denticle. When a short tooth is present in this position it is usually comparable in size with others on the pronotal margin. Propodeal spines usually dorsoventrally flattened, only rarely otherwise . . . . . 24
- 23 Sculpture of dorsal alitrunk a very distinct rugoreticulum with strongly reticulate-punctate interspaces. Lateral margins of mesonotum usually with one or more denticles. (Liberia, Ghana, Cameroun, Equatorial Guinea, Gabon, Congo, Zaire) *erineaceus* Stitz
- Sculpture of dorsal alitrunk variable in intensity but consisting essentially of a longitudinal rugation or sulcation which may be irregular or sinuate. Lateral margins of mesonotum usually without denticles. (Ivory Coast, Liberia, Ghana, Nigeria, Cameroun, Equatorial Guinea, Zaire, Uganda) *guineensis* F. Smith
- 24 Posterior one-quarter of first gastral tergite coarsely longitudinally sulcate, rugose or striate, this sculpture always very distinct and usually extending to the apex of the tergite . . . . . 25
- Posterior one-quarter of first gastral tergite reticulate-punctate or finely superficially sculptured and shining; a few fine scattered longitudinal rugulae formed by the fusion of the margins of aligned punctures may sometimes be present . . . . . 27
- 25 Smaller species, HW < 0.90, with relatively large eyes, OI 50 or more. (Zaire, Kenya) *striativentris* Santschi

- Larger species, HW > 0.95, with relatively smaller eyes, OI in range 34–48 . . . . . 26
- 26 Dorsal surfaces of head and alitrunk with numerous conspicuous relatively long stout hairs.  
Eyes slightly larger, OI range 43–48. (Kenya, Mozambique, South Africa) . . . . . *wissmanni* Forel
- Dorsal surfaces of head and alitrunk with relatively few inconspicuous very short stubbly hairs.  
Eyes slightly smaller, OI range 34–40. (Ethiopia, Somali Republic, Kenya, Tanzania, Zambia,  
Malawi, Zimbabwe, Mozambique, Angola, South West Africa, South Africa) . . . . . *intrudens* (F. Smith) (part)
- 27 Occiput with a distinct deeply incised transverse groove above the foramen. Below this the  
remaining strip of the occiput juts out as a shield over the dorsal rim of the foramen itself.  
(Uganda) . . . . . *impressus* Bolton
- Occiput without a deeply incised transverse groove above the foramen . . . . . 28
- 28 Subpetiolar process complex, anteroventrally with a prominent broadly rounded angle and  
posteroventrally with an extended heel or spur; the surface between these two usually  
concave. Postpetiole with a strongly developed simple long digitiform ventral process . . . . . 29
- Either the subpetiolar process simple, a rectangular or subrectangular lobe without the above  
configuration or with a feebly prominent acute angle or small tooth posteroventrally; if the  
latter then the postpetiole with a short blunt or short tooth-like ventral process . . . . . 35
- 29 Eyes relatively small, OI < 50 . . . . . 30
- Eyes relatively large, OI 50 or more . . . . . 32
- 30 Propodeal spines long, 0.40 or more in profile (in HW range 1.10–1.26), strongly divergent and  
markedly elevated; in profile the spines distinctly longer than the maximum length of the  
petiole. (Cameroun, Zaire) . . . . . *greggi* Bolton
- Propodeal spines short, < 0.25 in profile (in HW range 0.90–1.04), not strongly divergent nor  
markedly elevated; in profile the spines distinctly shorter than the maximum length of the  
petiole . . . . . 31
- 31 Stout hairs on cephalic dorsum extremely dense, appearing as a bristly pelt in profile. A line  
across the dorsum at the midlength of the eyes with many more than 10 hairs. Hairs on  
dorsum of head more or less cylindrical, not spatulate; the hairs truncated apically, their sides  
more or less straight and parallel. (Zaire) . . . . . *cestus* (p. 360)
- Stout hairs on cephalic dorsum sparse, not giving the appearance of a bristly pelt in profile. A  
line across the dorsum at the midlength of the eyes with at most 10 hairs. Hairs on dorsum of  
head conspicuously spatulate, broadly convex apically, their sides shallowly convex and  
convergent basally. (Kenya) . . . . . *kenyensis* (p. 358)
- 32 Most or all of stout hairs on clypeus and dorsum of head increasing markedly in thickness from  
base to apex, frequently 2–3 times broader at apex than at base. (Sierra Leone, Ghana,  
Cameroun, Chad, Zaire) . . . . . *pygmaeus* André
- Most or all of stout hairs on clypeus and dorsum of head cylindrical or nearly so, not increasing  
markedly in thickness from base to apex; in some cases the hairs may broaden approximately  
to their midlength and then continue at that width to their apices . . . . . 33
- 33 Mesonotal and propodeal dorsa with very fine superficial low irregular weak wandering  
rugulae, feeble or faded out in places but never evenly spaced nor regularly longitudinal.  
Spaces between these fine rugulae densely strongly reticulate-punctate and dull. (Ghana,  
Congo, Zaire) . . . . . *weissi* (p. 358)
- Mesonotal and propodeal dorsa with conspicuous strong broad longitudinal rugae which may  
be parallel but which are never faded out in places. Spaces between the rugae weakly  
superficially sculptured or unsculptured, the surfaces shining . . . . . 34
- 34 Entire body exceptionally highly polished and very shiny. Longitudinal rugae on posterior half  
of mesonotum and on propodeum very broad, subsulcate and parallel, without anastomoses  
on the propodeum. (Nigeria) . . . . . *taylori* (p. 364)
- Dully shining, not obviously highly polished. Longitudinal rugae on posterior half of  
mesonotum and on propodeum not subsulcate, not parallel, tending instead to diverge and  
converge slightly along their lengths or to be weakly wavy; on the propodeum with  
anastomoses. (Benin Republic) . . . . . *difficilis* Santschi
- 35 Hairs on dorsum of head exceptionally short, forming only a minute stubble on the surface.  
Dorsum of head usually meeting occipital surface in a marked angle or edge, the one not  
rounding evenly into the other . . . . . 36
- Hairs on dorsum of head conspicuous and quite dense, not represented only by a minute  
stubble on the surface. Dorsum of head rounding into occipital surface . . . . . 37

- 36 Tooth on mesokatepisternum large, long and acute, projecting anteriorly and usually clearly visible in dorsal view, projecting beyond the margins of the mesonotum. (South Africa) *micans* Mayr
- Tooth on mesokatepisternum small and short, usually a mere denticle or acute angle, sometimes not even as strong as this; not visible in dorsal view. (Ethiopia, Somali Republic, Kenya, Tanzania, Malawi, Zimbabwe, Mozambique, Angola, South West Africa, South Africa). *intrudens* (F. Smith)
- 37 Larger species, HW > 1.10, PW > 0.90. (Zaire). *bequaerti* Forel
- Smaller species, HW < 1.10, PW < 0.90 38
- 38 Pronotum laterally with a number of irregular rounded tuberculiform projections, without a regular series of denticles although some of the projections appear to consist of 2 or more denticles fused together. (South Africa) *fricatidorsus* Santschi
- Pronotum laterally with a more or less regularly spaced series of denticles. 39
- 39 Dorsal surfaces of mesonotum and propodeum extremely finely and very densely more or less evenly longitudinally rugulose, the rugulae so close together that the spaces between them are wide enough for only 1–2 rows of punctures. (Cameroun) *mckeyi* Snelling
- Dorsal surfaces of mesonotum and propodeum coarsely rugose, the rugae predominantly longitudinal but with some strong cross-meshes, breaks or irregularities. The rugae widely spaced so that the spaces between most of them accomodate many more than 2 rows of punctures. (Ghana, Nigeria, Cameroun, Zaire, Sudan, Uganda, Tanzania, South Africa) *traegaordhi* (p. 358)

***Cataulacus lujae* Forel sp. rev.**

*Cataulacus lujae* Forel, 1911b: 311. Syntype workers, ZAIRE: Kasai, Kondue (*Luja*) (MHN, Geneva) [examined]. [Wrongly synonymized with *brevisetosus* Forel by Bolton, 1974: 31.]

*C. lujae* var. *gilviventris* Forel should be included as a synonym of *lujae*, not of *brevisetosus*.

***Cataulacus jeanneli* Santschi sp. rev.**

*Cataulacus jeanneli* Santschi, 1914a: 108, fig. 16. Holotype worker, KENYA: Gazi, 20 km S. of Mombasa, st. no. 6, xi. 1911 (*C. Alluaud & R. Jeannel*) (NM, Basle) [examined]. [Wrongly synonymized with *brevisetosus* by Bolton, 1974: 31.]

The names *pygmaeus* st. *degener* Santschi and *janneli* [sic] var. *loveridgei* Santschi should be included in the synonymy of *jeanneli*, not of *brevisetosus*. The types of *loveridgei* still have not been found; the holotype of *brevisetosus* has now been located in MHN, Geneva.

***Cataulacus weissi* Santschi**

*Cataulacus weissi* Santschi, 1913: 310. Holotype worker, CONGO: Brazzaville, 1907 (*A. Weiss*) (NM, Basle) [examined].

*Cataulacus jeanneli* var. *aethiops* Santschi, 1924: 220. Syntype workers, ZAIRE: Kidada-Kitobola, 14–25.ii.1922 (*H. Schouteden*) (MRAC, Tervuren) [examined]. **Syn. n.**

***Cataulacus kenyensis* Santschi stat. n.**

*Cataulacus jeanneli* st. *kenyensis* Santschi, 1935: 272, figs 6a–c. Syntype workers, KENYA: Nairobi, st. 2, 1660 m, 1932–33 (*C. Arambourg, P. Chappuis & R. Jeannel*) (NM, Basle) [examined]. [Wrongly synonymized with *weissi* by Bolton, 1974: 39.]

***Cataulacus traegaordhi* Santschi sp. rev.**

*Cataulacus traegaordhi* Santschi, 1914b: 24, fig. 3. Syntype workers, female, male, SOUTH AFRICA: Natal, Zululand, Dukudu, 27.vii.1905 (*I. Trägårdh*) (NM, Basle) [examined]. [Wrongly synonymized with *pygmaeus* André by Bolton, 1974: 48.]

Of those names formerly included as synonyms under *pygmaeus*, the forms *C. trågårdhi* [sic] var. *ugandensis* Santschi, *C. marleyi* Forel (types in MHN, Geneva, not previously seen), and *C. pygmaeus* subsp. *suddensis* Weber should now be included in the synonymy of *traegaardhi*, not of *pygmaeus*.

*Cataulacus centrurus* sp. n.

(Fig. 33)

HOLOTYPE WORKER. TL 3.9, HL 1.00, HW 0.92, CI 92, EL 0.47, OI 51, SL 0.48, SI 52, PW 0.70, AL 1.10.

With the head in full-face view the lateral margins of the head behind the eyes denticulate, terminating posteriorly in a short tooth at the occipital corner. Occipital crest absent, the dorsum of the head rounding evenly but narrowly into the occipital surface; the occipital margin itself unarmed except for a small tooth situated close to the tooth at the corner. Eyes relatively large, OI > 50. Alitrunk with promesonotum both longitudinally and transversely convex. In profile the highest point at about the midlength of the pronotum, the remainder sloping evenly downwards posteriorly to the base of the propodeal spines. Anterior strongly curved portion of pronotal dorsum with a number of minute peaks or tubercles from which hairs arise; such peaks absent elsewhere on alitrunk. Tooth at base of mesokatepisternum developed. Propodeal spines in profile with the basal third elevated at an angle of about 45°, the apical two-thirds back-curved. Metapleural lobes low and rounded. With the alitrunk in dorsal view the pronotal corners denticulate and the lateral margins of the pronotum armed with a series of 6–7 regularly spaced triangular denticles. Lateral margins of mesonotum with a pair of small denticles whose bases are fused, situated at approximately the midlength. Following the metanotal indentation of the margin the sides of the propodeum are equipped with 2–3 small tubercles. Propodeal spines in dorsal view broad and evenly divergent. Petiole in profile rising to a sharp peak dorsally, behind which the surface slopes evenly downwards to the postpetiolar junction. Subpetiolar process with a bluntly rounded anterior lobe and a weakly developed posteroventral tooth. Postpetiole in profile with its dorsal and posterior surfaces tuberculate and its ventral process simple, short digitiform. First gastral tergite not marginate laterally, conspicuously longer than broad. Dorsum of head finely and evenly reticulate-rugulose, the reticular meshes of irregular size and the rugulae low and rounded. Ground-sculpture in the meshes reduced to an inconspicuous vestigial superficial shagreening, without punctulae. Pronotal dorsum similarly but somewhat more strongly sculptured, the reticulum breaking down on the mesonotum so that the longitudinal component predominates and the cross-meshes are reduced or incomplete. Propodeal dorsum more strongly and predominantly longitudinally rugose, irregular centrally. Transverse rugae are present between the bases of the propodeal spines. Ground-sculpture of alitrunk mostly as head but the mesonotum with some minute and virtually effaced punctulae. Petiole in dorsal view longitudinally rugose, the sculpture converging posteriorly. Postpetiole dorsum irregularly rugulose. First gastral tergite blanketed by fine dense reticulate-punctate sculpture, the basal quarter also with widely spaced fine longitudinal costulae. Behind this level the tergite with scattered short longitudinal rugulae which are very fine and irregular and formed by the alignment of the margins of adjacent punctures. First gastral sternite reticulate-punctate. Sides of pronotum obliquely sulcate, the mesopleuron transversely sulcate and the sides of the propodeum more or less vertically so behind the level of the spiracle. Sides of petiole and postpetiole longitudinally sulcate-rugose. Discounting the long simple hairs which arise round the eyes the entire dorsum of the head thickly clothed with stalked-suborbicular hairs, the stems of the hairs long and fine and holding the suborbicular distal portions well clear of the surface of the head. Occipital surface with a number of elongate narrowly clavate hairs. All remaining dorsal surfaces of body densely clothed with moderately long stout cylindrical simple hairs which are truncated apically; those on the alitrunk and petiole straight, those on the postpetiole and first gastral tergite weakly back-curved. Colour uniform black, glossy; the scapes, tibiae and tarsal segments dull yellow.

Holotype worker, **Cameroun**: Nkoemvon, 1979 (*D. Jackson*) (BMNH).

As indicated by the stalked-suborbicular cephalic hairs *centrurus* belongs to the complex of species centring on *brevisetosus*, and is most closely related to the smaller *moloch*. In the latter species the simple pilosity of the alitrunk and gaster is very short and stubble-like, whereas in *centrurus* it is long and conspicuous (Figs 33, 34). The specialized cephalic hairs of *moloch* are sparser than in *centrurus*, have the basal stems of the hairs shorter and the apices less strongly expanded. With the head in profile the specialized hairs immediately in front of the eye have the basal stem longer than the swollen apex in *centrurus*, shorter than the swollen apex in *moloch*. In profile the propodeal spines of *centrurus* have the basal third elevated and the apical two-thirds

recurved, a feature not seen in *moloch* where the spines are exceedingly feebly but evenly curved along their length. Finally, the shape of the subpetiolar process differs in the two species, that of *moloch* having the posteroventral angle more salient and the ventral surface more concave than in *centrurus*.

***Cataulacus cestus* sp. n.**

HOLOTYPE WORKER. TL 4.0, HL 1.00, HW 0.99, CI 99, EL, 0.45, OI 45, SL 0.48, SI 48, PW 0.76, AL 1.10.

Sides of head behind eyes denticulate, terminating in a larger denticle at the occipital corner. Occipital crest absent but the occipital surface shallowly concave above the foramen and meeting the dorsum in an angle, the two surfaces not evenly rounded together. Occipital margin unarmed except for a denticle or short tooth close to the one at the corner. Eyes relatively small, OI < 50. With the alitrunk in profile the dorsum evenly shallowly convex between the more steeply sloped anterior portion of the pronotum and the base of the propodeal spines. Pronotal and propodeal surfaces beset with small peaks or tubercles in profile, the mesonotal dorsum also having such peaks but they are here more scattered and much lower, having the appearance of minute irregularities in the outline. Mesokatepisternal tooth small. Metapleural lobes rounded. Propodeal spines in profile short, more or less straight, only very slightly elevated. Alitrunk in dorsal view with the pronotal corners denticulate, the lateral marginations of the pronotum behind the corners with 6–7 sharp triangular denticles projecting laterally. Sides of mesonotum with 1–2 small denticles and sides of propodeum also with 1–2, occurring on the convexity over the spiracle. Propodeal spines short and broad, widely divergent. Petiole node in profile rising to an acute peak dorsally. The subpetiolar process with a rounded and slightly prominent anteroventral lobe and a triangular projecting posteroventral tooth or heel; the ventral surface between the two angles feebly concave. Postpetiole in profile high, its dorsal surface with a number of conspicuous peaks or tubercles and its ventral process short-digitiform. Dorsum of head irregularly reticulate-rugose, the meshes of varying size and the rugae low and rounded. Many of the reticular meshes incomplete or with their walls broken. Ground-sculpture within the meshes a very fine superficial shagreening or granular roughening of the surface, not reticulate-punctate. Dorsal alitrunk irregularly reticulate-rugose everywhere, many of the rugal meshes incomplete or broken and very irregular in shape. Ground-sculpture finely reticulate-punctate to densely shagreened. Petiole node in dorsal view strongly longitudinally rugose, the rugae converging posteriorly. Postpetiole irregularly rugulose and finely densely punctulate. First gastral tergite coarsely and densely reticulate-punctate everywhere, the whole surface also loosely covered with anastomosing fine irregular superficial rugulae which are strongest basally and fade out apically on the sclerite. First gastral sternite similarly sculptured. Entire dorsum of head covered with a dense pelt of short straight erect bristly blunt hairs which are cylindrical to subcylindrical in shape. All remaining dorsal surfaces of body with similar dense bristly pilosity. Colour uniform black; the scapes, tibiae and tarsi dull yellow.

PARATYPE WORKERS. TL 4.0–4.1, HL 0.98–1.02, HW 0.98–1.02, CI 98–100, EL 0.45–0.48, OI 46–47, SL 0.48–0.50, SI 49–51, PW 0.76–0.86, AL 1.08–1.16 (4 measured).

As holotype but in some the gastral rugulae are less strongly developed and in one the gastral rugulae are effaced. The ventral surface of the subpetiolar process may be more strongly concave than is the case with the holotype.

Holotype worker, **Zaire** (B. Congo on data label): Ituri For., Beni-Irumu, ii.1948, no. 2122 (*N. A. Weber*) (MCZ, Cambridge).

Paratypes. 1 worker with same data as holotype; 1 worker with same data as holotype but no. 2120; 2 workers with same data as holotype but no. 2119. (MCZ, Cambridge; BMNH).

***Cataulacus jacksoni* sp. n.**

HOLOTYPE WORKER. TL 3.5, HL 0.98, HW 0.94, CI 96, EL 0.46, OI 50, SL 0.49, SI 52, PW 0.68, AL 0.98 (cephalic measurements approximate as head crushed).

With the head in full-face view the sides behind the eyes minutely denticulate. Occipital crest absent, the dorsum rounding into the occipital margin. Head of holotype crushed behind level of eyes and the surface fractured; the fracture also running forward on the head along the inner margin of the right eye to the clypeus. With the alitrunk in profile the dorsal outline rising steeply to about the midlength of the pronotum. Behind this the remainder of the dorsum evenly shallowly convex to the bases of the propodeal spines, the outline not interrupted by superficial peaks or tubercles. Mesokatepisternal tooth small and broadly triangular. Propodeal spines in profile strongly downcurved along their length. Metapleural lobes

very small. With the alitrunk in dorsal view the pronotal corners angular, the angle slightly projecting. Sides of pronotum behind this not marginate, without a regular series of laterally projecting denticles. Instead the sides with only a blunt tubercle at the point of junction of the pronotum and mesonotum and with one or two minute irregularities, too low, small and blunt to be called tubercles or denticles, situated behind the corner. Sides of mesonotum and propodeum unarmed and immarginate, the latter with a low salient welt at the site of the spiracle. Propodeal spines in dorsal view curved, bowed outwards along their length. Petiole in profile blunt above, not rising to a sharp peak. Subpetiolar process with the anteroventral angle rounded, the posteroventral angle acute and slightly projecting. Postpetiole in profile very high and narrow, with a flat anterior face and a long simple ventral process. In dorsal view the postpetiole with the sides converging dorsally so that the node narrows from base to apex. Dorsum of head to level of posterior margins of eyes finely longitudinally rugose, behind this level the head with very heavy broad strong sulci. Ventral surface of head longitudinally sulcate. Dorsal alitrunk regularly strongly longitudinally sulcate except for the area between the bases of the propodeal spines where the sulci are arched-transverse. Propodeal declivity transversely sulcate. Coxae, femora and tibiae of legs all longitudinally sulcate. Anterior face of petiole node transversely sulcate, the dorsum with U-shaped sulci. Upper half of anterior face of postpetiole vertically sulcate. Sides of alitrunk diagonally sulcate from anteroventral to posterodorsal on each sclerite except on the mesokatepisternum where they run from posteroventral to anterodorsal. First gastral tergite and first sternite covered with strong parallel longitudinal sulci throughout. Dorsum of head with abundant stalked-suborbicular hairs which have slender basal stems. Remainder of dorsal surfaces of body with sparse fine curved hairs which are very feebly clavate apically. Colour uniform black but scapes, anterior tibiae and tarsi, and tarsi of middle and hind legs dull yellow.

Holotype worker, **Cameroun**: Nkoemvon, 1980 (*D. Jackson*) (BMNH).

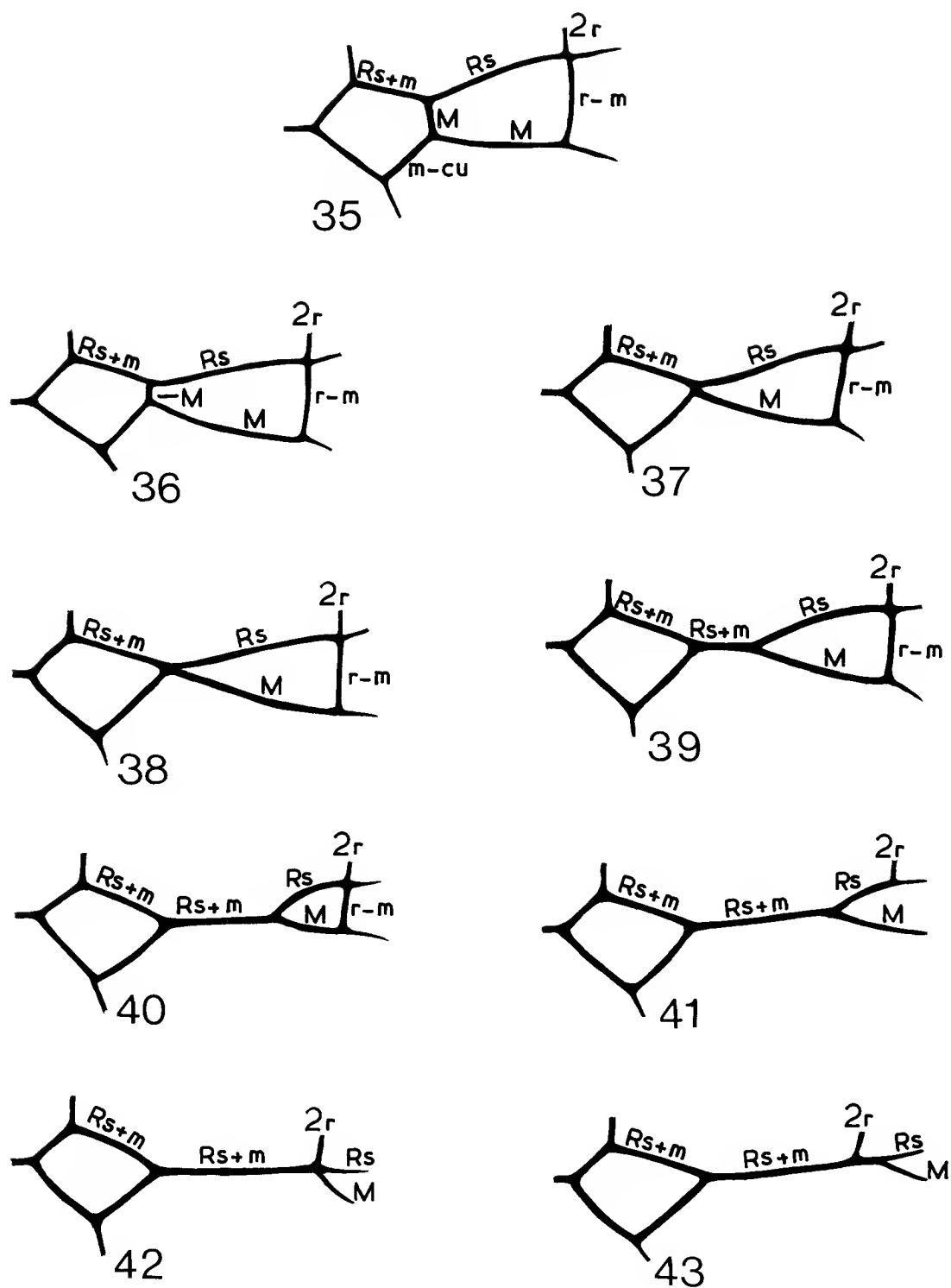
The characteristic strong sulcate sculpture of this species, coupled with its possession of immarginate and unarmed lateral pronotal margins, stalked-suborbicular cephalic hairs, and propodeal spines which are bowed outwards in dorsal view and downcurved in profile, make *jacksoni* very easily recognisable.

### *Cataulacus moloch* sp. n.

(Fig. 34)

HOLOTYPE WORKER. TL 3.4, HL 0.90, HW 0.80, CI 89, EL 0.43, OI 54, SL 0.42, SI 53, PW 0.60, AL 0.94.

With the head in full-face view the sides behind the eyes denticulate, ending in a low triangular tooth at the occipital corner. Occipital margin with a small tooth close to the one at the corner but otherwise unarmed; the occipital crest absent, the dorsum rounding evenly into the occipital surface. Eyes relatively large, OI > 50. Alitrunk with promesonotum both longitudinally and transversely convex. In profile the alitrunk with its highest point at about the midlength of the pronotum, behind which the dorsum is evenly shallowly convex to the base of the propodeal spines. The steeply sloping anterior portion of the pronotal dorsum with a number of minute peaks or tubercles from which hairs arise, such peaks absent elsewhere on the dorsum. Tooth on mesokatepisternum moderately developed, distinct. Propodeal spines in profile scarcely elevated and almost straight, only very feeble downcurved along their length; not having the basal portions elevated and the distal portions recurved. With the alitrunk in dorsal view the pronotal corners with prominent acute dentiform angles. Pronotal margin behind the corners with 5–6 triangular, laterally projecting denticles which are quite evenly spaced. Sides of mesonotum with two small denticles, the sides of the propodeum convex over the site of the spiracles, with one or two minute tubercles. Propodeal spines broad in dorsal view and evenly divergent. Petiole in profile rising to an acute peak dorsally. Subpetiolar process complex, with a blunt and strongly prominent anteroventral angle and a tooth-like projecting posteroventral angle, the two separated by a conspicuously concave ventral margin. Postpetiole in profile with the dorsal and posterior surfaces distinctly denticulate, the subpostpetiolar process elongate-digitiform. Dorsum of head irregularly reticulate-rugulose, the reticular meshes of varying size and the rugulae themselves low and rounded. Ground-sculpture within the meshes reduced to an inconspicuous vetigial shagreening, without punctures. Pronotal dorsum similarly but more strongly sculptured, with a few low broad transverse rugae anteriorly but with the longitudinal component predominating behind this. On the mesonotum and propodeum the longitudinal component of the sculpture predominates, the rugae being broader and more strongly developed; many of the cross-meshes are feeble or incomplete. Rugae between bases of propodeal spines transverse. Petiole in dorsal view regularly longitudinally rugose, the rugae converging posteriorly; the postpetiole irregularly rugose. Ground-sculpture of alitrunk as on head. First gastral tergite blanketed by dense reticulate-punctuation, without strong basigastral rugulae but here and



Figs 35–43 Semi-diagrammatic representation of principal venation development on forewing of *Messor* and *Aphaenogaster*. For explanation see text, pp. 339–340.



there with feeble short rugulae formed by the alignment of margins of adjacent punctures. First gastral sternite reticulate-punctate. Sides of pronotum transversely sulcate. Discounting the long hairs which arise around the eyes the dorsum of the head with numerous stalked-suborbicular hairs, the basal stems of which are quite short. Occipital surface with longer hairs which increase in thickness from base to apex. All remaining dorsal surfaces of body with numerous short stout blunt hairs. On the alitrunk some of these hairs are slightly thicker apically than basally, these hairs straight everywhere except on the base of the first gastral tergite where they are slightly back-curved. Colour uniform black; the scapes, tibiae and tarsi dull yellow.

PARATYPE WORKERS. TL 2.8–3.2, HL 0.74–0.86, HW 0.68–0.72, CI 86–92, EL 0.39–0.42, OI 54–57, SL 0.38–0.40, SI 53–56, PW 0.50–0.60, AL 0.78–0.92 (3 measured).

As holotype but averaging slightly smaller.

Holotype worker, **Ghana**: Pankese, 24.ix.1968 (C. A. Collingwood) (BMNH).

Paratype. **Ghana**: 1 worker with same data as holotype. **Nigeria**: 2 workers, Onipe, CRIN, 11.vi.1975, tree 47–16 (A63.1), black pod project (B. Taylor) (BMNH).

*C. moloch* is closest related to *centrurus*, the differences between them are noted under the latter name.

### *Cataulacus satrap* sp. n.

HOLOTYPE WORKER. TL 3.5, HL 0.87, HW 0.82, CI 94, EL 0.44, OI 53, SL 0.40, SI 49, PW 0.56, AL 0.96.

With the head in full-face view the sides behind the eyes minutely denticulate, the denticles partially concealed by the thickened short hairs which project above them; the row of denticles ends in a small tooth at the occipital corner. Occipital crest absent, the dorsum of the head rounding into the occipital surface. Occipital margin unarmed except for a small tooth close to the one at the corner. Eyes relatively large, OI > 50. In profile the anterior outline of the pronotal dorsum sloping steeply, the surface equipped with a number of low peaks or tubercles. Behind this the remainder of the alitrunk shallowly but evenly convex, sloping down posteriorly to the base of the propodeal spines. Mesokatepisternal tooth prominent, moderately well developed. Metapleural lobes low and rounded. Propodeal spines in profile straight, only slightly elevated. With the alitrunk in dorsal view the pronotal corners angular and projecting. Sides of pronotum behind the corners only weakly marginate and with a series of 4–5 projecting denticles, all of which are small and widely spaced. In the holotype the right pronotal margin with 5, the left with 4 denticles. On both sides the posteriormost denticle the largest, the anteriormost distinctly smaller; the 2–3 between them minute and inconspicuous. Sides of mesonotum and propodeum without differentiated denticles. Propodeal spines in dorsal view broad and feebly divergent. Petiole in profile rising to an acute peak above. Subpetiolar process simple, with a bluntly rounded anteroventral angle and an acute, weakly projecting posteroventral angle, the two separated by a flat ventral surface. Postpetiole dome-like and high in profile, with two feebly developed peaks dorsally; the subpostpetiolar process short-digitiform and blunt. Dorsum of head irregularly reticulate-rugulose, the reticular meshes of uneven size and irregular shape, the rugulae low and rounded. Ground-sculpture of the rugular meshes a fine dense reticulate-punctuation. Dorsal alitrunk densely covered in fine rugulae which are low and rounded, reticulate in places but predominantly longitudinal behind the pronotum. Entire dorsum of alitrunk also blanketed by a fine dense and very conspicuous reticulate-punctate ground-sculpture. Petiole and postpetiole with dense reticulate-punctate sculpture, the former also with longitudinal rugae in dorsal view, the latter only with a few vestigial irregular rugulae. First gastral tergite strongly and densely reticulate-punctate everywhere. Dorsum of head with numerous distinctive stalked-suborbicular hairs, those situated anteriorly on the dorsum more strongly expanded apically than those situated behind the level of the eyes. All remaining dorsal surfaces of body with many very short thick blunt hairs. Colour uniform black, dull; the scapes, tibiae and tarsi dull yellowish brown.

PARATYPE WORKER. TL 3.4, HL 0.88, HW 0.80, CI 91, EL 0.43, OI 54, SL 0.40, SI 50, PW 0.57, AL 0.96.

As holotype but propodeal spines slightly less divergent and the subpetiolar process with the anteroventral and posteroventral angles separated by a feebly concave ventral surface. On the pronotal margins the anteriormost denticle behind the corner is no larger than those following it (except for the last in the row, which is the largest); and the left side of the pronotum with 5 denticles, the right side with 4.

Holotype worker, **Cameroun**: Nkoemvon, 1970, M12 (D. Jackson) (BMNH).

Paratype. 1 worker with same data as holotype (BMNH).

Related to *vorticus* which it resembles closely, *satrap* is immediately separated by its possession of denticles on the lateral pronotal margins.

*Cataulacus taylori* sp. n.

HOLOTYPE WORKER. TL 3.2, HL 0.82, HW 0.76, CI 93, EL 0.42, OI 55, SL 0.44, SI 58, PW 0.60, AL 0.90.

With the head in full-face view the sides behind the eyes denticulate, ending in a tooth at the occipital corner. Occipital crest absent, the dorsum rounding evenly into the occiput; the occipital margin unarmed except for a smaller tooth close to the one at the corner. Eyes relatively large, OI > 50. With the alitrunk in profile the highest point of the dorsum at about the midlength of the pronotum. In front of this the dorsum slopes down to the cervical shield and a few scattered minute peaks occur on the outline. Behind the highest point the dorsum is shallowly convex and slopes evenly downwards towards the bases of the propodeal spines. Mesokatepisternal tooth developed. Metapleural lobes low and rounded. Propodeal spines in profile narrow, slightly downcurved along their length. Alitrunk in dorsal view with the pronotal corners denticulate, the lateral margins of the pronotum with 6–7 projecting triangular denticles. Sides of mesonotum and propodeum each with a single projecting denticle, the latter also with the sides convex at the site of the spiracle. Propodeal spines narrow and evenly divergent in dorsal view. Petiole in profile rising to a sharp peak above. Subpetiolar process complex, with a narrow rounded projecting blunt anteroventral angle and a spur-like posteroventral angle, the ventral surface between the two angles strongly concave. Postpetiole node with dorsal surface denticulate, the ventral process narrow and digitiform. Dorsum of head feebly reticulate-rugulose, the rugulae very weak, fine, low and rounded, the reticular meshes mostly incomplete and irregular in shape and size. Ground-sculpture in the meshes almost completely effaced, the surface glossy. Dorsal alitrunk predominantly longitudinally rugose, with some anastomoses on the pronotum but behind this the rugae straight and parallel, quite broad and without cross-meshes. Spaces between the rugae glossy and almost smooth, with only the faintest vestiges of ground-sculpture. Rugae on declivity between bases of spines transverse. Petiole and postpetiole longitudinally rugose, the rugae converging posteriorly. First gastral tergite shiny, with superficial fine reticulate-punctulate sculpture everywhere and with a weak pattern of very fine longitudinal irregular rugulae. Stronger longitudinal rugulae present on the basal one-fifth of the tergite. First gastral sternite similarly but even more delicately sculptured. Dorsum of head with numerous short stout straight cylindrical hairs which are blunt apically. All remaining dorsal surfaces of body with similar pilosity, the longest hairs occurring on the base of the first gastral tergite where they are slightly recurved. Colour uniform glossy jet black; the scapes, tibiae and tarsi dull yellow.

PARATYPE WORKER. TL 3.5, HL 0.88, HW 0.81, CI 92, EL 0.45, OI 56, SL 0.46, SI 57, PW 0.67, AL 0.96.

As holotype but slightly larger, its subpostpetiolar process shorter and broader than in the holotype. The rugae on the dorsal alitrunk not running straight back as in the holotype but slightly skewed to the left posteriorly.

Holotype worker, **Nigeria**: Gambari, CRIN, 24.v.1976, black pod project (*B. Taylor*) (BMNH).

Paratype. **Nigeria**: 1 worker. Onipe, CRIN, 25.vii.1975, black pod project (*B. Taylor*) (BMNH).

## Appendix

The current genus-level synonymy of *Aphaenogaster* is as follows.

### *APHAENOCASTER* Mayr

*Aphaenogaster* Mayr, 1853: 107. Type-species: *Aphaenogaster sardoa* Mayr, 1853: 107, by subsequent designation of Bingham, 1903: 270.

*Deromyrma* Forel, 1913c: 49 [as subgenus of *Ischnomyrmex* Mayr]. Type-species: *Aphaenogaster* (*Ischnomyrmex*) *swammerdami* Forel, 1886b: cvi, by monotypy. [Synonymy by Brown, 1973: 180.]

*Planimyrmica* Viehmeyer, 1914: 604 [as subgenus of *Aphaenogaster*]. Type-species: *Stenammina* (*Ischnomyrmex*) *loriai* Emery, 1897: 563, by original designation. [Synonymy by Brown, 1973: 184.]

*Attomyrma* Emery, 1915: 70 [as subgenus of *Aphaenogaster*]. Type-species: *Formica subterranea* Latreille, 1798: 49, by original designation. [Synonymy by Brown, 1973: 178.]

*Novomessor* Emery, 1915: 73. Type-species: *Aphaenogaster* (*Ischnomyrmex*) *cockerelli* André, 1893: 150, by original designation. [Synonymy by Brown, 1974: 47.]

*Nystalomyrma* Wheeler, 1916: 215 [as subgenus of *Aphaenogaster*]. Type-species: *Myrmica longiceps* F. Smith, 1858: 128, by original designation. [Synonymy by Brown, 1973: 183.]

*Brunella* Forel, 1917: 234. Type-species: *Aphaenogaster* [sic] *belti* Forel, 1895: 248, by original designation.

Syn. n.

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